INDUSTRIAL RADIOACTIVE WASTE DISPOSAL

HEARING

BEFORE THE

SPECIAL SUBCOMMITTEE ON RADIATION

OF THE

JOINT COMMITTEE ON ATOMIC ENERGY

CONGRESS OF THE UNITED STATES

EIGHTY-SIXTH CONGRESS

FIRST SESSION

ON

INDUSTRIAL RADIOACTIVE WASTE DISPOSAL

JULY 29, 1959

VOLUME 5

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NOTE

This is volume 5 of the record of "Hearings on Industrial Radioactive Waste Disposal." Volumes 1 to 4 covered the hearings on January 28, 29, 30, and February 2 and 3, 1959, pertaining to the nature of radioactive wastes, waste management operations, the waste disposal research and development program, future estimates and economics of waste disposal, and activities of Federal, State, and international agencies in the regulation of disposal of radioactive wastes.

On July 29, 1959, the Special Subcommittee on Radiation held an additional day of public hearings on the specific subject of disposal of low-level radioactive wastes into the ocean. In particular, the special subcommittee felt it advisable to receive further testimony from technical experts concerning the NAS–NRC Working Group report on "Radioactive Waste Disposal Into Atlantic and Gulf Coastal Waters," made public in the spring of 1959 after the completion of the January and February 1959 hearings.

This volume 5 consists of the record of the July 29, 1959, hearing and includes a number of statements from interested Senators and Congressmen on the subject of disposal of radioactive wastes into the Atlantic Ocean and Gulf of Mexico.

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INDUSTRIAL RADIOACTIVE WASTE DISPOSAL

WEDNESDAY, JULY 29, 1959

CONGRESS OF THE UNITED STATES,
SPECIAL SUBCOMMITTEE ON RADIATION,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D.C.

The subcommittee met, pursuant to notice, at 2 p.m., in room P–63, the Capitol, Hon. Chet Holifield (chairman of the subcommittee) presiding.

Present: Representatives Holifield, Durham, Price, Aspinall, Thomas, Hosmer, and Bates; Senators Anderson (chairman of the joint committee), Pastore, Jackson, and Hickenlooper.

Also present: James T. Ramey, executive director; David R. Toll, staff counsel; George E. Brown, Jr., professional staff member; and Edward J. Bauser, technical adviser, Joint Committee on Atomic Energy.

Representative HOLIFIELD. The committee will be in order.

Before we make our opening statement, we have some of our colleagues from the House of Representatives who are very much interested in this matter, and we have extended the courtesy of inviting them to sit with the committee this afternoon. If they have questions which they would like to ask the witnesses, please feel free to do so.

The Special Subcommittee on Radiation has been directed by Chairman Anderson to hold hearings this afternoon and tomorrow, if necessary, on the specific subject of disposal of low-level atomic wastes in ocean waters. We have requested representatives of the Atomic Energy Commission to appear, in view of the fact that the Atomic Energy Act of 1954 places responsibility upon the AEC in site selection and the development of regulations to protect the public health and safety. We have also requested representatives of the National Academy of Sciences, which has recently made a study on the possible sites, to appear and testify.

This subcommittee held extensive and detailed hearings January 28–February 3, 1959, on the subject of industrial radioactive waste disposal. These hearings covered all aspects of the waste disposal problem, including the various types of wastes, a survey of future quantities, and a study of whether or not our research and development and regulatory programs are adequate. During these hearings, 33 scientists and experts testified, and statements were received from more than 50 other persons. These hearings are now being published by the Government Printing Office in four volumes, over 3,000 pages in length, which will be ready for distribution in the near future.

We expect that a complete coverage of all facets of the problem will be presented, including the procedure and criteria in site selection, a description of the types of wastes involved, the meaning of the term

"low level" when used to describe atomic wastes, the types of protective shielding and packaging required, the competence and reliability of licensees, the equipment used by licensees, and all other pertinent factors involved.

While it is not contemplated that nongovernmental witnesses will be invited to testify at these particular hearings, the record is open for a limited time for the filing of statements by Members of Congress and other responsible witnesses.

Our first Government witness this afternoon is General Luedecke, General Manager of the AEC, who will be accompanied by members of his staff. However, before General Luedecke takes the chair, we have several Members of Congress, and Senator Yarborough, of Texas, here who have a few remarks and statements which they would like to file with the committee.

STATEMENT OF HON. RALPH W. YARBOROUGH, A U.S. SENATOR FROM THE STATE OF TEXAS

Senator YARBOROUGH. I have a statement to file with the committee for inclusion in the record in support of this legislation, there now being no existing statutory limitations as to where the Atomic Energy Commission might dump this material. This legislation, we think, would set up minimal requirements by requiring that it not be put in the shallow surface waters, but be carried out at least 200 miles, and at least a thousand fathoms in depth. My statement supports that. I will ask leave of the committee to file it.

Representative HOLIFIELD. Thank you, Senator.

(Senator Yarborough's statement referred to follows:)

Mr. Chairman, and members of this distinguished committee, thank you for extending me the time in support of H.R. 8187, a bill by the Honorable Clark Thompson, one of my colleagues from Texas.

Although I'm sure that Congressman Thompson will tell, or has told, you of the great concern among many Texans concerning the dumping of radioactive wastes in the Gulf of Mexico, I cannot emphasize too strongly our opposition to plans for dumping such wastes close to shore and in shallow water. While I do not want to burden your record, I do have quite a volume of protests, communications, and data from Texas organizations which have been studying this situation, all condemning the dumping of radioactive wastes in the western edge of the gulf.

While I am here to speak in behalf of this bill, which imposes restrictions on dumping radioactive wastes in the gulf, I believe that I should make it clear that many of us accept it only as a lesser of two evils. At this point, when we are dealing to a great degree with an unknown quantity that is hazardous to all mankind, many of us would like it better if there were no dumping at all. But we have decided from what we have been able to read and learn on the subject, that this bill is far better than the present unlimited authority of the Atomic Energy Commission to license dumping in 5 feet of surf if their whimsey so dictates.

Certainly, Congressman Thompson's bill is a great improvement and safeguard over AEC's announced plans to dump radioactive wastes in the gulf just 21 miles off Galveston and in other relatively shallow areas close to land. The provisions of this bill, calling for disposal at least 200 miles from shoreline and in depths at least 1,000 fathoms (6,000 feet) in a leakproof container is a long step in the right direction—namely deeper and further away.

Mr. Chairman, my differing with the excellently trained men of the AEC in this matter does not mean that I question their judgment or lack confidence in their outstanding work. It simply means that I, like many residents of America's shorelines, feel that this is a matter upon which there cannot be the slightest doubt. A mistake here could be fatal.

Surely we all know that the U.S. men of science have just started to learn about the hazards of radioactivity.

A great deal remains to be researched on this subject. Experts have offered conflicting statements as to how much is the "permissible limit"—or the amount of radiation a human body can stand.

This is a subject of vital importance because scientists tell us an overdose of radiation is most hazardous to children and can affect generations 100 and 200 years in the future.

In considering this subject, I have been forcefully struck by the amount of study which is still necessary.

It was only on the first of this month that I read in a Texas newspaper that the U.S. Public Health Service is planning to study the effects of the dumping of radioactive wastes into our coastal waters.

The Atomic Energy Act made the Atomic Energy Commission responsible for safegarding the public's health. We have read in the newspapers recently about the contamination of streams, particularly in the western part of our country. The need for some action in this field of protection of the public is evident.

I would like to quote from an editorial of the St. Louis Post-Dispatch which was reprinted in the Austin (Tex.) American Statesman for July 24, 1959:

"That the work must urgently be done, whatever the agency that does it, is beyond question. By its own account, the AEC is obviously not doing it. The Commission lacks adequate jurisdiction and enforcement powers. It has no one directly in charge of its program for measuring the extent and hazards of radioactive fallout from weapons tests."

Some of our rivers have been polluted by dumping radioactive wastes. We should not compound this error by taking action which could do the same thing to our shallow, inshore coastal waters.

More care needs to be exercised in the disposal of the radioactive wastes to assure protection of both marine and human life. This is particularly important since scientists tell us more of our food supply of the future may come from the sea.

A great many Americans derive their livelihood from the gulf, and many more enjoy the fishing and boating and other recreational activities of the area.

Mr. Chairman, I know this committee will carefully consider this matter and act to protect the people of the United States from dangers which might result from dumping radiactive wastes near land and in too shallow water.

Thank you for your courtesy in this hearing.

Representative HOLIFIELD. At this time, are there any other gentlemen from the House who would like to file a statement?

Representative THOMAS. Mr. Chairman, Mr. Thompson from Texas is here, who would like to file a statement.

STATEMENT OF HON. CLARK W. THOMPSON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Representative THOMPSON. Mr. Chairman, I could either read the statement into the record, or file it with you, as you desire.

Representative HOLIFIELD. If it is all right with you, sir, in order to save time, we would prefer to file it. If you wish to give it, however, the Chair will extend you that courtesy.

Representative THOMPSON. I appreciate it very much. On your assurance that it will be given consideration, Mr. Chairman, I shall not take up the time of the committee.

Representative HOLIFIELD. It will certainly be given consideration. We will be glad to have you sit in with the committee and listen to the testimony.

(Representative Thompson's statement referred to follows:)

To the Chairman and Members, Joint Committee on Atomic Energy:

Mr. Chairman, I appreciate very much the opportunity to appear and file a statement with reference to my bill H.R. 8187, to impose certain restrictions on disposing of radioactive material by depositing it in the Gulf of Mexico, and for other purposes.

First, I would like to give you some of the background which led to my introduction of this measure. In January of 1958, the Industrial Waste Disposal Corp. filed a request for a license to receive, package, and store for a limited period of time low-level radioactive waste materials in Houston, Tex., and to dispose of this waste material at a point off the coast of Texas in the Gulf of Mexico. This request was objected to by, among others, officials in Harris County, Tex. The Atomic Energy Commission, however, finally granted the license, good for 2 years, to carry out the proposals in the application.

Word of the proposal brought a great deal of objection from various citizens along the coast of Texas. Fishermen, both sport and commercial, and innumerable citizens who wish to use the Texas coast for recreation and business purposes; fish and wildlife authorities of the State; chambers of commerce; newspapers; and others have voiced their objections to the operation in any form.

Permit me to say that I know of no Member of Congress along the Texas coast, or in any other coastal waters, who likes the idea of garbage of any kind, particularly radioactive garbage, being dumped in waters which have heretofore been spared such a procedure and which are used for any purpose by the citizens of the country.

I have resorted to the bill which you now have under consideration for various reasons, to a large extent because of the justifiable apprehension on the part of the people I represent and, also, because it appears that there is a division of authority, and certainly a division of opinion, as to just what would constitute a safe program. Certainly I understand, as I believe we all do, that one of the difficult features of the program which is entrusted to this committee is the lack of information on the part of the public. We are told of the grave dangers of radioactive materials, of the awesome results of the fallout, of the importance of avoiding areas which are contaminated. We hear, also, of the pollution of streams, caused by dumping the same sort of material into streams as would now be dumped in the Gulf of Mexico. We hear of the steps being taken to insure proper (whatever that is) protection in the handling of the very material which is under consideration today.

On June 12 of this year, a group of Texas coast Congressmen met in my office and discussed this entire subject with Messrs. Leibermann, Rogers, and Plaine, all officials of the Atomic Energy Commission. We discussed at length the waste-dumping proposal. I came out of the conference, which lasted several hours, with various convictions:

(1) For one thing, the material which is involved is dangerous. Otherwise, it would not be sealed in steel drums and encased in concrete.

(2) It is not safe to deposit these materials, except in waters at least 1,000 fathoms deep. Otherwise, the Atomic Energy Commission would not have required that the dumping process take place only in waters of such depth.

(3) At the 1,000 fathoms depth, the proposed containers would implode; and if they did not disintegrate entirely, they would "probably" spring leaks and permit the material to contaminate the waters in the area. We were assured, however, that at such a depth and at the distance from shore where such depths are found—"150 miles off Galveston"—there would be no danger involved.

We requested, and I believe the Atomic Energy Commission officials agreed, that before any such operation should proceed, the AEC should hold hearings and otherwise take steps to satisfy the citizens in the areas affected by any such proposal that there would be no danger whatsoever in the operation involved.

There was a good deal of discussion as to how the Atomic Energy Commission proposed to police or inspect the operation and how they would make certain that it would not take place except in specified areas. Assurance was given that qualified inspectors would supervise each operation.

In the discussion which took place, considerable sentiment was voiced by Members of Congress that the operation might start out with due consideration for whatever regulations might be set up but that after a vessel is out of sight of land, particularly at night, it would be very hard to say whether the material was dumped at one spot or another. We also wondered whether, after the initial phase of the operation had passed, permission might not be granted to move in much closer to shore. We were far from satisfied, although we did not question the good intent of the Atomic Energy Commission.

Within a few days after our meeting with the AEC officials, the National Academy of Sciences—National Research Council published a statement of its findings concerning the question of radioactive waste disposal. Twenty-eight public disposal sites were recommended. Those which concern Texas Members the most are those affecting the waters off Galveston, Sabine Pass, and

Corpus Christi. Those which affect other gulf waters are, undoubtedly, equally as serious to the representatives of those areas as are those which concern the Atlantic coast waters.

The areas suggested off the Texas coast are 21 miles off the Galveston entrance, 19 miles from Sabine Pass, and 65 miles off Aransas Pass, which is the entrance to the Corpus Christi harbor. I invite to your attention the fact that 21 miles from Galveston is well within the waters used by sport and commercial fishermen, and it is not deep water at all. The Continental Shelf lies beyond this area, and I doubt if the water in the vicinity is more than 50 feet deep.

I have not analyzed the conditions in other areas proposed by the National Academy of Sciences—National Research Council, but from expressions by colleagues of mine concerned with the Atlantic waters, I take it that they are just as objectionable in those waters as they are in the Gulf of Mexico.

The statement to which I now refer indicates very strongly that there is a wide difference of opinion between the Atomic Energy Commission and the Council. The citizens involved are certainly not satisfied, and the doubts which have assailed the lay mind are increased by such evident differences among the experts.

May I remind the committee that while all of this discussion was going on, on July 4, a steel drum washed up on an Oregon beach. The drum was marked to indicate that it contained dangerous radioactive materials. It was promptly taken in charge by Government authorities, and other than a suggestion that it "might be a hoax," I have seen no official statements concerning it.

During the same period, we learned from the Fish and Wildlife Service that they regard very skeptically the dumping of the proposed containers in any area where seining might take place. There has already been difficulty with nets picking up and becoming fouled by similar containers which were deposited offshore, adjacent to the mouth of the Mississippi River.

All in all, we face a situation so disquieting that I have been impelled to introduce my bill, H.R. 8187. I am very glad to note that this measure has been endorsed by the gentleman from Rhode Island, Mr. Forand, who has suggested that it be amended to include Atlantic, as well as Gulf of Mexico waters. I also note that the gentleman from Florida, Mr. Bennett, has introduced a bill which I believe is identical to mine, except that it calls for protection of the Atlantic waters. I welcome both of these proposals.

My bill imposes restrictions which are far more acceptable than those which are now proposed administratively by any of the agencies involved. While my people still do not want any dumping of garbage, particularly radioactive garbage, in the Gulf of Mexico, if it must be done, they very much prefer that it be suitably regulated. I regret very much that it has become necessary to introduce legislation. I think the matter should have been, and still might be, handled administratively. I believe that the process of burying the materials at a suitable depth in the ground or depositing them in vacated mine shafts, or otherwise permanently sealing them off from public contact, would be the best solution.

I look to you to share in the protection of my people, as you would protect your own.

CLARK W. THOMPSON,
Ninth District, Texas.

Representative HOLIFIELD. Mr. Casey.

STATEMENT OF HON. BOB CASEY, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Representative CASEY. I would like to file a statement within the next 2 days, if I may, please, sir, and I have had prepared a very graphic map which shows the area off the gulf coast of Texas opposite Galveston which will show you very graphically the spots suggested by the report, and also the fishing banks and shrimping area.

Representative HOLIFIELD. Would you like to go down front at this time, Congressman, and display the map? I will ask a couple of staff members to hold that map for him, please.

Representative CASEY. This is a map of the Mississippi River to Galveston. This is Galveston Bay. The Mississippi River Basin is over here. The red spots, marked "No. 1," are some of the spots that have been designated in the Gulf of Mexico. Here is one right off Galveston, and one right off here at Sabine Pass.

Senator HICKENLOOPER. Is the blue area—marked "No. 2"—the Continental Shelf?

Representative CASEY. No, sir. This is the 10-fathom curve. This is within the 10-fathom curve.

Senator HICKENLOOPER. Where is the Continental Shelf shown?

Representative CASEY. It is so far out here it is not on this map, sir. These are fishing banks, marked "No. 3."

Senator HICKENLOOPER. Below that blue line?

Representative CASEY. Yes, sir. This is your 50-fathom curve. This is where the snapper and commercial sports fishing banks are located off the gulf coast of Texas. The shaded area, marked "No. 4," is the shrimping area. Of course, there is also some deep shrimping done even farther out than this. I think this graphically displays the nearness of some of these proposed sites to very active commercial and sports fishing. All the depths are marked, and we are talking only about somewhere in the neighborhood of 50 feet of water.

Senator HICKENLOOPER. Then you designate roughly the approximate distance from shore of the shrimping area?

Representative CASEY. This shrimping area, I would say, is about a 15-mile line from shore.

Senator HICKENLOOPER. In other words, the shrimping areas indicated by the dark portion marked "No. 4" on that map will be some 15 to 30 miles wide depending on the location?

Representative CASEY. Yes, sir.

Senator HICKENLOOPER. About how far out from the Texas gulf shore there is it? It looks uniform until you get to the mouth of the Mississippi River. About how far offshore is the 10-fathom curve?

Representative CASEY. This is one of their designated points off Galveston.

Senator HICKENLOOPER. I mean just roughly.

Representative CASEY. Right here it is about 25 miles.

Senator HICKENLOOPER. It is roughly 25 or 30 miles out from the shore all along there, as I view it.

Representative CASEY. Yes, sir.

Senator HICKENLOOPER. Then about how far out is the 100-fathom curve?

Representative CASEY. This is the 50-fathom curve, marked "No. 5."

Senator HICKENLOOPER. That is represented by the blue line?

Representative CASEY. Yes, sir. That would be approximately 65 to 70 miles.

Senator HICKENLOOPER. The commercial and sport fishing areas designated by the gray circles is just seaward of the 50-fathom blue line curve there.

Representative CASEY. Yes, sir. Incidentally, Senator, there are other fishing banks here that I have personal knowledge of.

Senator HICKENLOOPER. The major ones, I take it, you have designated just off the 50-fathom curve?

Representative CASEY. Yes, sir.

Representative DURHAM. I would like at this point to quote from the statement of General Luedecke where he says:

It is emphasized that the Commission has not made a decision to use or approve the use of these inshore sites, even if the results of the studies and investigations are favorable from a safety standpoint. Such decision is a question for future consideration.

In addition, if a site were definitely established as suitable for use as a disposal ground without endangering the health and safety, the Commission would not license the commercial use of the site without providing an opportunity for a public hearing on the matter, as required by its rules of practice.

Representative CASEY. That is why I noted them as suggested sites. They were just suggested by that report.

Senator PASTORE. It still remains that an ounce of prevention is worth a pound of cure.

Representative CASEY. That is why I am here, sir.

Senator PASTORE. That is why we are all here.

Representative CASEY. I would like to leave this for the committee's use, if I may.

Representative HOLIFIELD. The committee will be glad to accept that, and also your statement, sir.

Representative CASEY. Thank you very much.

(The statement and maps referred to by Congressman Casey follows:)

Mr. Chairman, and members of the committee, I first became concerned about the matter of disposal of radioactive waste when a corporation in my home city of Houston, Tex., was licensed by the Atomic Energy Commission to dispose of such waste.

Of course, I, as most laymen, was a little afraid of radioactive materials, being ignorant as to their effects and how safely they might be handled.

In particular that is so in our area because of the fact a little over a year and a half ago we had an unfortunate accident where some employees were working in an industry which used radioactive materials in their work, and we had contamination not only of the plant but of these employees' homes.

Therefore, any mention of radioactive materials in our area naturally causes quite a disturbance.

This industry, Industrial Waste Disposals, Inc., was licensed to dispose of radioactive waste, and the license provided that they would dispose at a site in the gulf approximately 180 miles off the coast in 1,000 fathoms of water.

I did not become too concerned about that authorization due to the fact I felt that the safeguards they had placed in the license indicated that they who had knowledge of these materials were taking proper precautions, and also I know that in our own Texas Medical Center they use a considerable amount of radioactive materials in medicine and research which under proper precautions is bound to be safe, and if it were not I am sure the men who know the uses of this material would never allow it to be right in the heart of our medical center.

Also, I thought our people were about to accept these pronouncements as being proper, when along came the National Academy of Sciences' report in which they recommended a location just 20 miles off the coast in 54 feet of water.

I am very familiar with the spot they located just off Galveston because I have personally caught many a red snapper and many fish of various species there; it is quite a popular place to fish.

I began to see what the basis of these recommendations were.

Of course, immediately the National Academy of Sciences comes back and says, "We made these recommendations subject to studies."

I want to point out to the chairman that I think the National Academy of Sciences was presumptuous in making definite site locations at this time because in the very foreword of their report they state they were supposed to make a detailed study.

I do not think they have made such a detailed study. If they are just going to pick our sites, they can easily pick out any point just a few hundred feet

off the coast, so far as that is concerned, if the location is subject to detailed study being conducted later.

That was not my understanding. My understanding was that the report was to have included a detailed study to begin with, and I think they have certainly harmed the program of meeting this problem we have. I say "we" because disposing of such waste is a problem that the whole Nation will have from now on.

They have not helped this thing at all by coming out in this manner, with definite spots picked out where there has been no detailed study made.

The National Bureau of Standards put out a handbook, No. 58, in 1954 entitled "Radioactive Waste Disposal in the Ocean." In this booklet they moved with caution, and properly so. They recommended disposal, if it should be in ocean waters, to be in depths where the water exceeds a depth of 1,000 fathoms.

They also made the observation that disposal by pipeline was undesirable.

Great Britain has been disposing of some of these radioactive materials by pipeline, and you will hear a lot of fine talk about how successful that has been and how it empties into a kelp bed and they harvest this kelp. They have made all sorts of studies, and the pipeline operation works fine. There is proper dispersal, and there is no aftereffect either on marine life or plant life.

I think again you have to take into consideration the currents, sedimentation, and so forth on each particular location.

The original recommendation of the National Bureau of Standards did not recommend a pipeline at all.

They state on page 4 of that publication: "Disposal of radioactive waste through pipelines is considered undesirable." That is very flatly stated.

We have no definite studies which have been made with reference to the maximum permissible concentration, and in none of the publications has there been a study with reference to maximum concentration, nor has there been a study made with regard to dispersion, either in the upper layers or lower layers of the oceans. I think that is something your committee perhaps should be very concerned with, detailed studies which will bring about a proper guide as to dispersion and disposal of radioactive waste materials in the ocean.

Another thing that will concern us all is the control of dumping these materials in the ocean. After all, we have control of our waters only a certain distance from our shores, and the oceans are free, and there is a good possibility some other country might choose our offshore sites to dump materials, and I don't know how we can stop them so far as that is concerned.

By the same token, I wonder about how we are going to control our own licensed people other than by the license itself as to where they will dump this material, because once they are out into the free high seas the only control we would have would be by nature of what we can do with them when they get back to shore should they not follow the purposes of their license.

It looks like this might develop into an international question as to these disposal sites.

The National Academy of Sciences put out some other reports with reference to this subject. One of them was, published in 1957, publication No. 551, is a very exhaustive piece of work entitled "Effects of Atomic Radiation on Oceanography and Fisheries." In this volume they point out the hazards through recovery of containers.

In other words, they state fishermen might bring these containers up in their nets if they are not properly disposed of, and you would find fishermen exposed to this material unless it is properly placed at a dept where it would not interfere with the fishermen's nets.

It is not unusual for fishermen to bring up junk which has been dumped out in their fishing grounds, unknown to them, and it not only damages very expensive nets but in this instance it might very well mean some exposure to them which might cause injury or death.

They point that out, and it is a very practical consideration.

In this book, which was just published by this same organization 2 years ago, they go into great detail about the fact that knowledge of radiation effects on marine organisms is inadequate for any firm conclusions.

If they had any experiments in order to reach firm conclusions they do not give indication of it in these later publications. They point out that sites which provide the least hazard may involve the greatest disposal cost. I grant that may be true, that these sites isolate the materials so no part of their entry back to the land or any place which might come in contact with man is limited.

That may be true, but I think in this instance cost should not be considered when we are talking about the safety of our people and the use of our beaches not only for recreation but the waters are also important to our marine life, which is a strong segment of our economy as well as a source of food for our people.

On page 21 of this report they state: "Our knowledge of most of the processes in the ocean are altogether too fragmentary to permit precise predictions of the results of the introduction of a given quantity of radioactive materials at any particular place.

"In order to obtain the necessary knowledge, an adequate long-range program of research in physics, chemistry, and geology of the sea and on the biology and ecology of its contained organisms is required. Such research must be directed toward the understanding of general principles, not simply to the ad hoc solution of a particular local problem for immediate application.

"The latter sort of study is desirable in order to provide engineering solutions to particular waste-disposal problems as they arise. Such engineering solutions must necessarily be of limited application and, more, they must always be conservative at least until sufficient broad understanding is obtained."

Then, Mr. Chairman, they follow that with a list of the major unsolved problems. I will just give you the headings of those without reading them. They list them:

(1) Dispersion in the upper mixed layer.
(2) Circulation in the intermediate and deep layers.
(3) Exchange between the surface layer and deeper layers.
(4) Sedimentation process.
(5) Effects of the biosphere on the distribution and circulation of elements.
(6) Uptake and retention of organisms used as food for man.
(7) Effects of atomic radiation on populations of marine organisms.

As far as I know, these major problems are still unsolved because this is a publication by the same group which put out this recent publication.

This same year, 1959, this National Academy of Sciences, the National Research Council, put out a booklet "Artificial Radioactivity in the Marine Environment."

They reiterate some of the very same things they did in publication No. 551, and that is mostly lack of knowledge and the fact that detailed studies are needed.

I would like to point out to the chairman that particularly in my own area, in one of these booklets they have a study with a general statement as to the tides and currents, and in those instances in my own area off the coast of Texas it is quite obvious that you have very little current, lots of sedimentation, and all these things which would lead you to be afraid to use that particular area for any disposal purposes, particularly of materials such as this.

I hope that this committee will in the first place allay the fears of my people that these specific sites as pointed out in this most recent publication will not be used as recommended here, and that the public will be protected by proper studies to gain the knowledge that is needed to meet this problem.

I will not say that I do not want any materials dumped in the waters off the coast of Texas because I think that would be foolish. We are living in a changing world. I know that, and I think the people I represent are intelligent enough to know that, but if we are going to rely on people whom we presume have the knowledge to deal with this problem I certainly think they should be cautioned not to presume that we know so much about it, and that their language should be carefully studied before they release a publication of this sort, somewhat as is referred to in the legal profession—the big words give it to you and the little ones take it away.

First they say, "These sites would be fine." Then they say, "If studies are made and are found to be acceptable."

We have quite a public relations job to do between the scientific mind and the layman's mind in understanding this tremendous problem.

I do not want any activities, scientific or otherwise, which will be beneficial to my community to be discouraged from coming into my community.

I know the field of radioactive materials in use in peacetime is growing day by day, and I want my community to share in those growths and in those developments, so I want a healthy climate and I want an understanding with my people.

By the same token, I do not want them subjected to something which on its very face shows that it would be dangerous or a wild-eyed experiment or pre-

sumptuous on someone's part to just pick out a spot and use it for dumping something. It is perhaps used to dump trash, but not used to dump material such as this which can be washed back onto the beaches or can settle into the bottom of this shallow water where our marine life will pick it up.

In conclusion, Mr. Chairman, I would like to inform the committee that I endorse the purposes of Congressman Clark Thompson's bill, H.R. 8187, which this committee has before it for consideration. I believe the bill will preserve the coastal waters of our Nation in safety for the use of our people and fishing industries.

Representative HOLIFIELD. We would be happy to have you sit in for the rest of the afternoon.

Congressman Bennett.

STATEMENT OF HON. CHARLES E. BENNETT, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF FLORIDA

Representative BENNETT. I would like to associate myself with the statement made by Senator Yarborough. I have introduced a companion bill to that of Congressman Thompson. I appreciate your consideration.

Representative HOLIFIELD. Thank you very much.

Your statement may be inserted in the record at this point.

(Congressman Bennett's statement referred to follows:)

Mr. Chairman, I appreciate this opportunity to testify today on radioactive waste disposal into Atlantic and gulf waters. My interest in this subject arises out of the recommendation by the National Academy of Sciences that two of the disposal locations be in the Atlantic Ocean 18 and 83 miles, respectively, from our district's beaches. This is uncomfortably close. Not being an atomic scientist, I cannot speak authoritatively as to whether any radioactive danger to the district which I represent would result. However, I note in the report which recommended these locations that it is axiomatic that there will be some escaping radiation. The report says at page 1:

"The primary objective of the study has been to provide an estimate of the rate of return of radioactive substances to man arising from stated rates of disposal into the coastal areas."

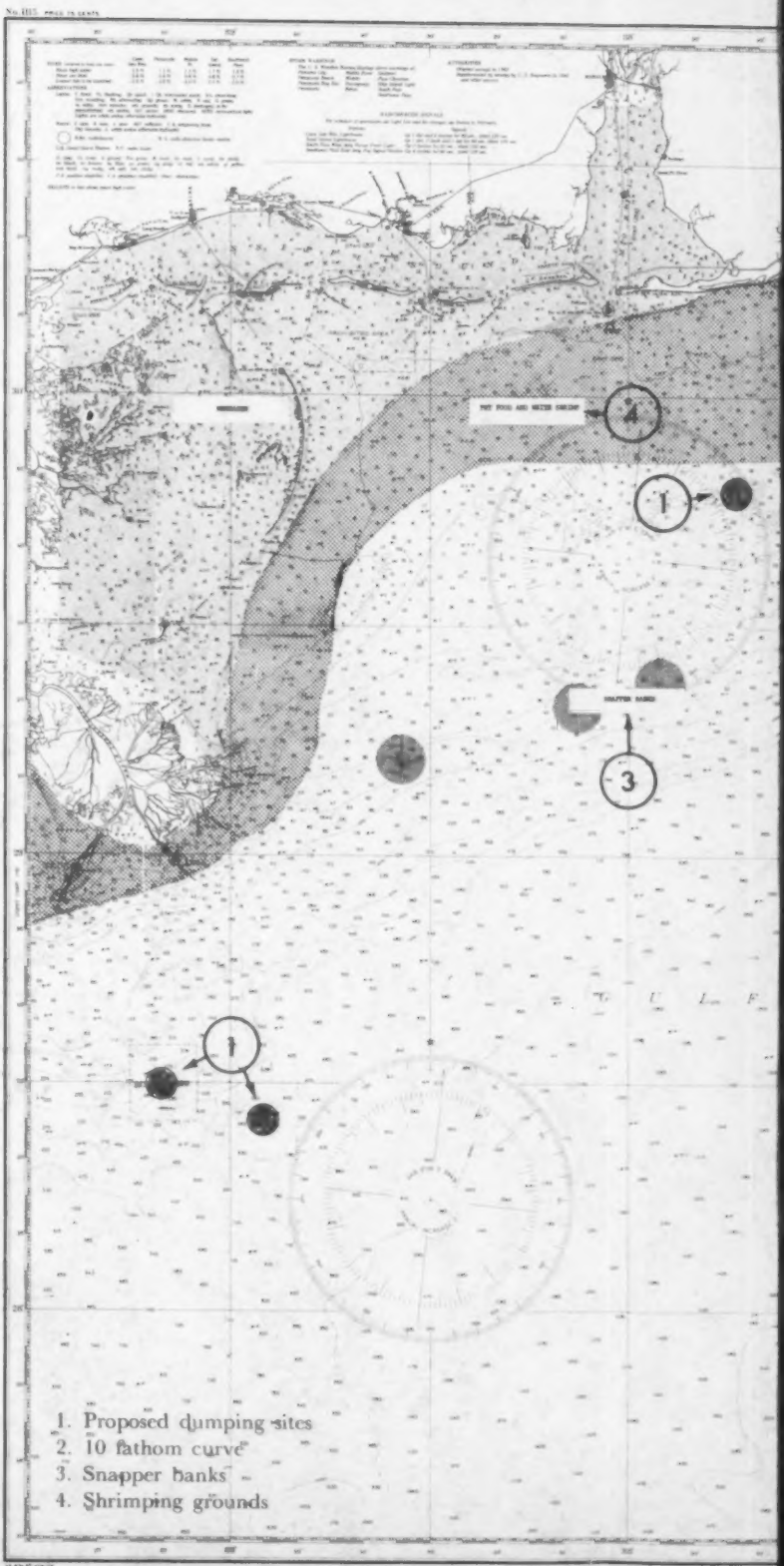
Thus, the report admits there will be some rate of return. The recommendations in the report are for the purpose of reducing this admitted "rate of return" to safe levels.

Perhaps those in charge of the program will tell you that they can easily accomplish this reduction to safe levels. Nevertheless, here is a danger that utilizing locations so close to our beaches will have a damaging psychological effect in our area. Adjacent to these locations are our beautiful Duval County beaches, which attract large numbers of vacationers and bathers. In these waters a considerable amount of fish, shrimp, and other sea products are obtained. If there should arise an apprehension concerning the safety of these waters and beaches from a radioactive standpoint, a severe economic hardship might result, whether or not these fears are justified. Accordingly, it is my hope that these two locations near our coast can be abandoned in favor of locations at least several hundred miles from the nearest land. I will greatly appreciate any assistance your subcommittee can give toward this objective. As a means of having a concrete proposal before you, I have introduced H.R. 8423, which is identical to H.R. 8187, introduced by Congressman Clark Thompson, except that my bill relates only to the Atlantic Ocean and his relates only to the Gulf of Mexico. Perhaps an amendment of H.R. 8187 to include the Atlantic Ocean might be an orderly way of handling this legislation.

Although the Atomic Energy Commission announced yesterday that it has no immediate plans to use any of the inshore water sites recommended in the report, I believe it is nevertheless very important that legislation of this type be enacted. Only by enacting these bills can we be certain that this threat will not again arise in the future or that this inshore dumping will not be quietly carried out by the present commission or its successors.

Thank you again, Mr. Chairman, for permitting me to express these views.

Representative HOLIFIELD. Congressman Rogers of Florida.



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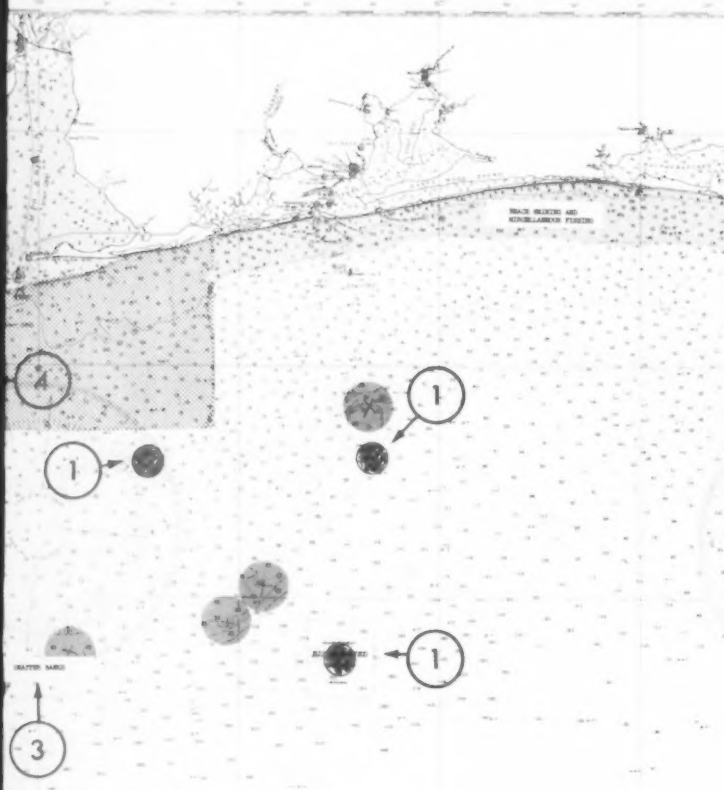
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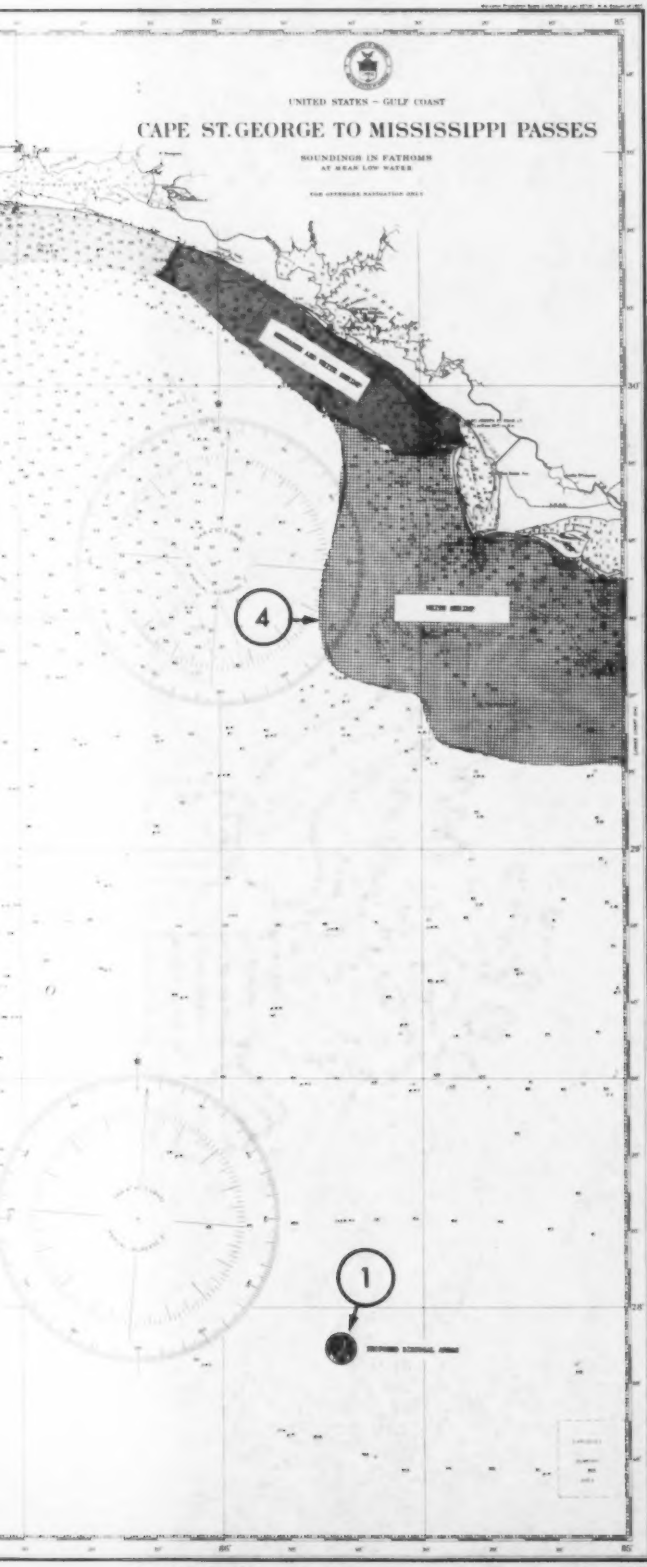
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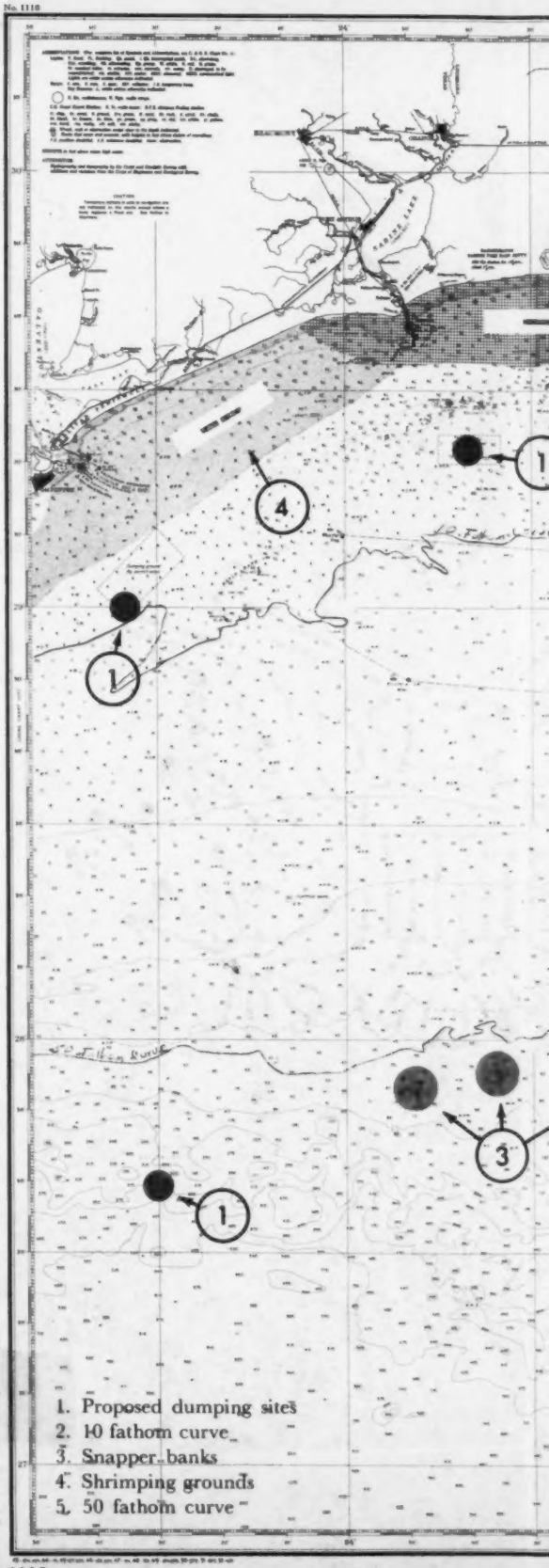

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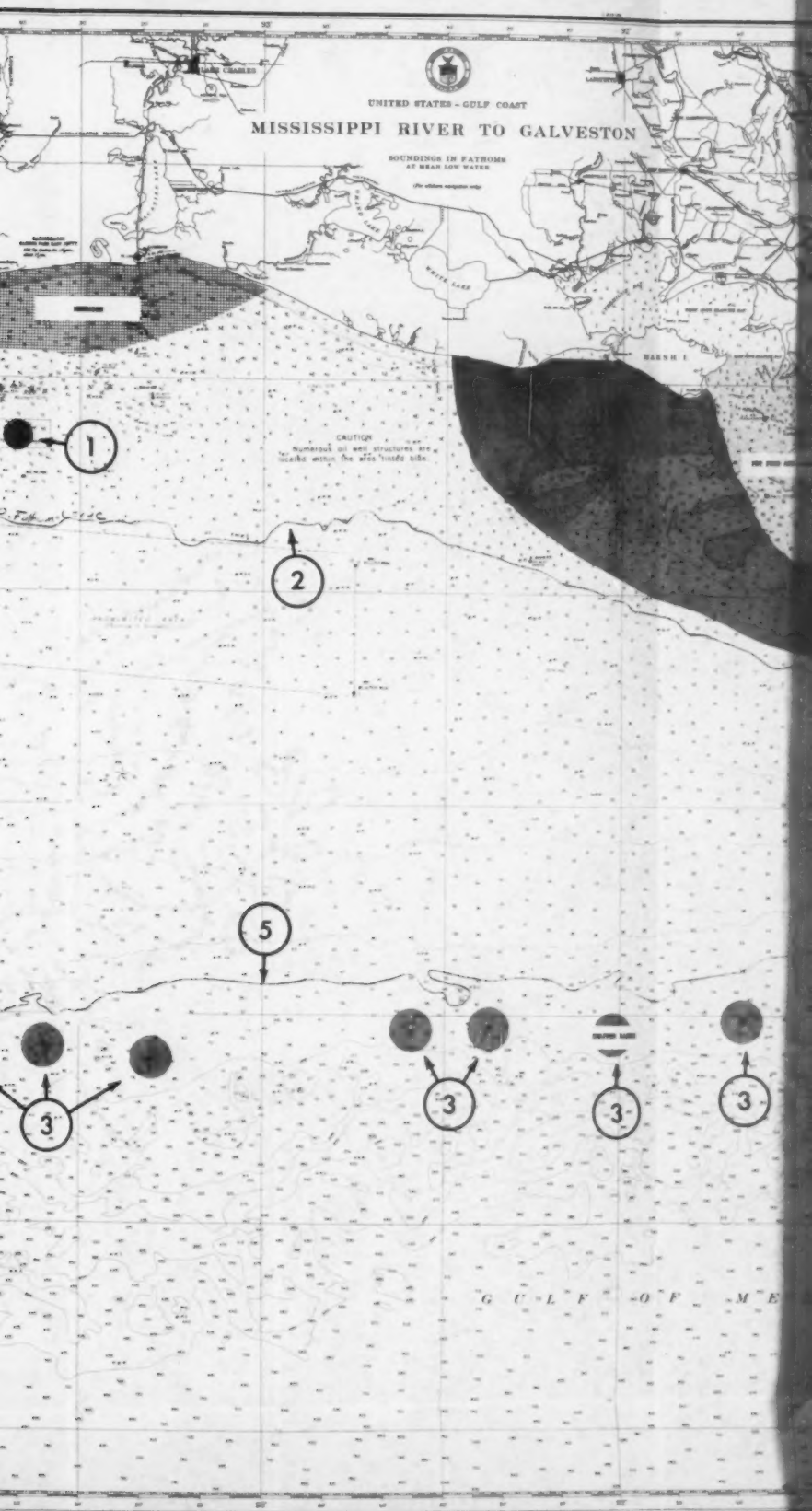

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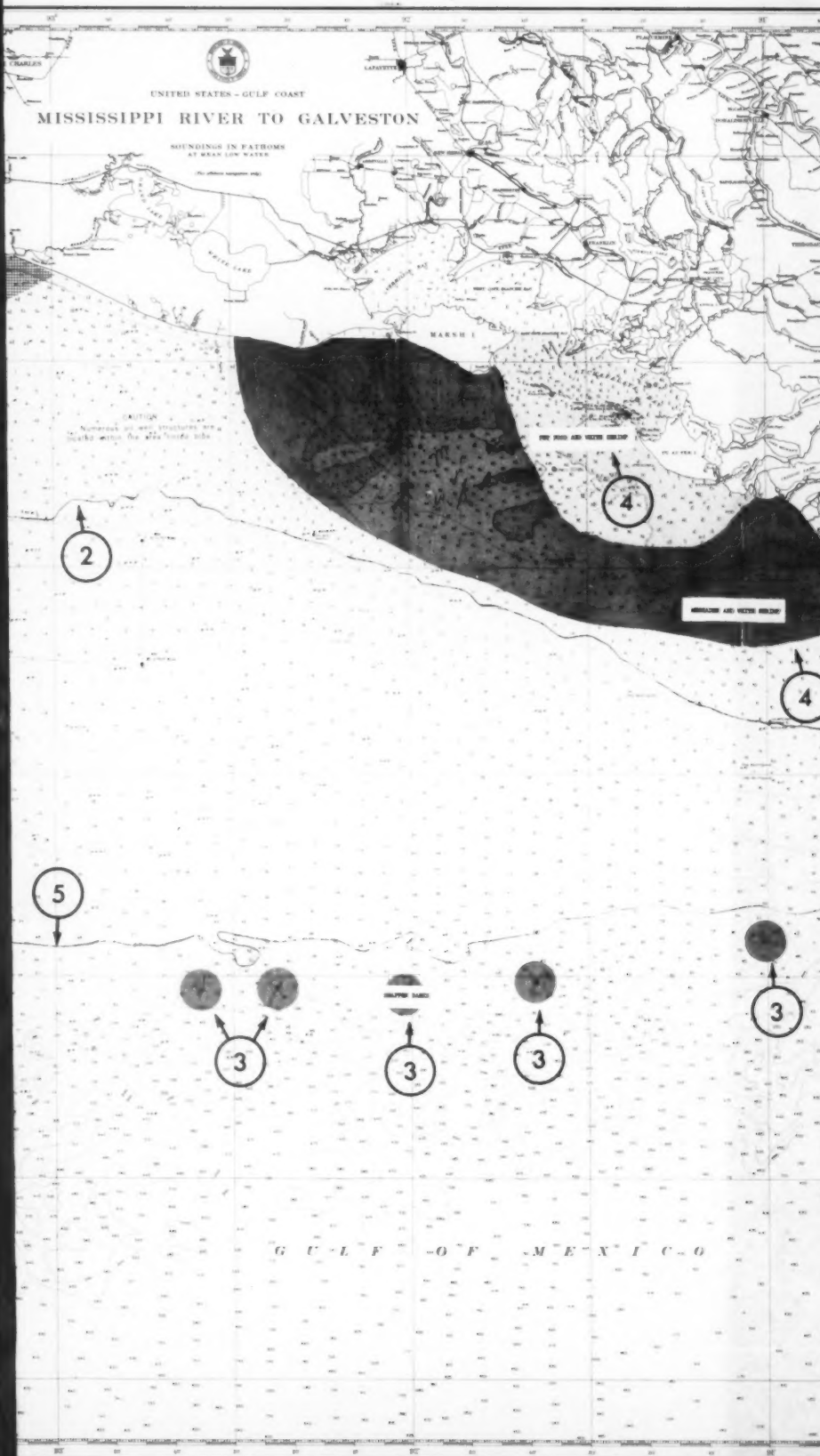
E. F. A. Dodd, Director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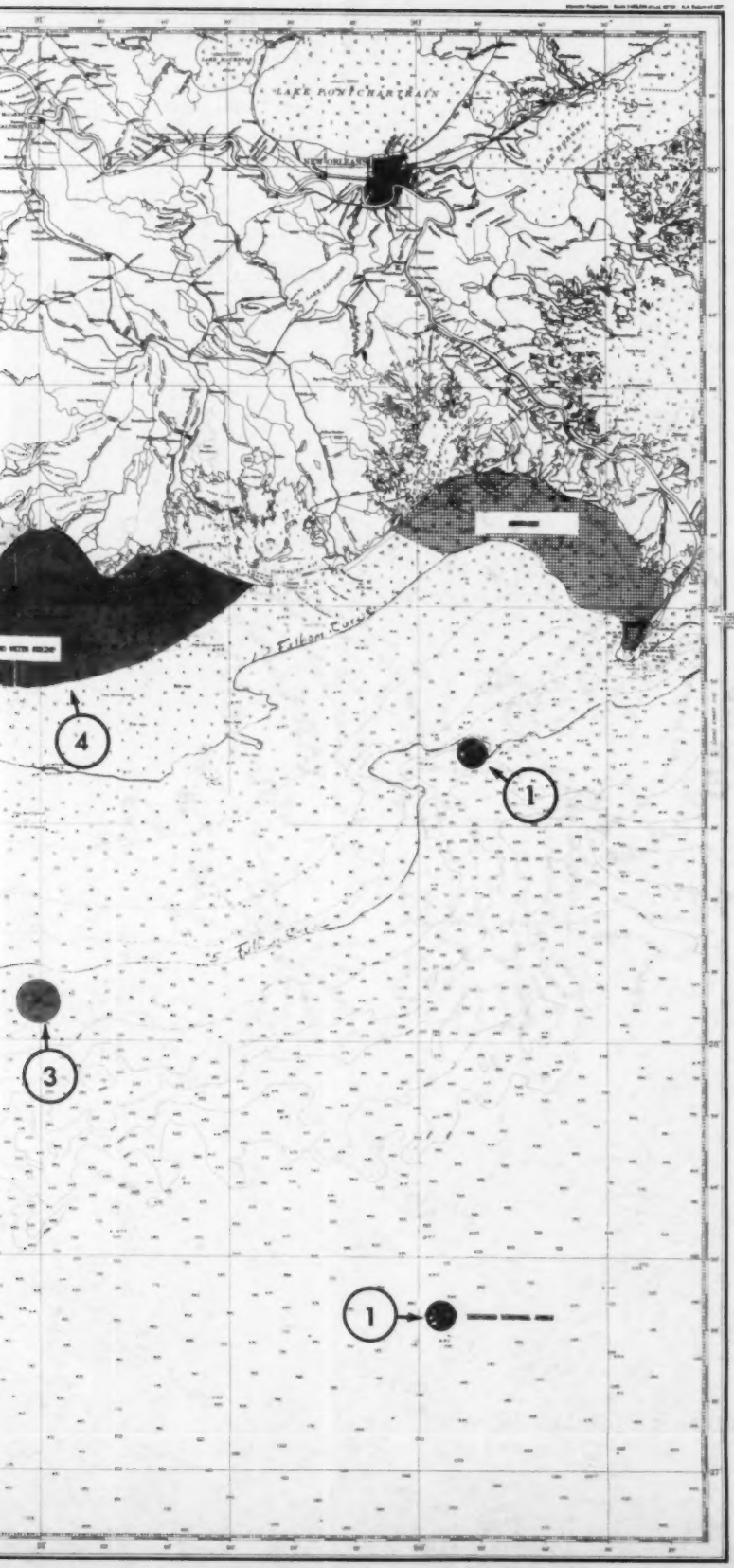
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STATEMENT OF HON. PAUL G. ROGERS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF FLORIDA

Representative ROGERS. Mr. Chairman, I appreciate the opportunity to be heard and file a statement in support of legislation to see that we have certain minimum requirements.

Representative HOLIFIELD. Thank you very much.

Your statement may be inserted in the record at this point.

(Congressman Roger's statement referred to follows:)

Mr. Chairman and members of this committee, I appreciate the opportunity to offer a statement in connection with a matter of grave importance to a large segment of the population comprising the Sixth District of Florida, which I am privileged to represent. I also appreciate the kind offer to sit with this distinguished committee today to hear further testimony on this important matter.

The matter to which I refer, Mr. Chairman, is the recent study conducted by the Oceanography Committee of the National Academy of Sciences. In its report, the committee proposed a number of sites along the eastern seaboard and gulf coast which it considered suitable for the disposal of low level radioactive waste material. The proposed site with which I am particularly concerned, and I believe rightfully so, lies in the Gulf Stream 2 miles oceanward from the Port Everglades sea buoy or about 3 miles east of Fort Lauderdale, Fla.

Try as I might, Mr. Chairman, I can conceive of no logical reason why a site only 3 miles from a congested resort area was proposed for the dumping of this potentially dangerous radioactive refuse. The Fort Lauderdale area is one of the fastest growing areas in the country. During the winter season, literally hundreds of thousands of visitors combine with some 300,000 permanent residents to frequent our spacious beaches. One of the prime attractions presented to our touring friends is the game fish which abounds in abundance in and around the Gulf Stream. Boating in small pleasure craft as a means of recreation is presently enjoying unprecedented popularity. Millions of dollars have been expended by our merchants through their associations and otherwise to acquaint the world with this vacationers paradise.

Now we are informed that there is a proposal under consideration, which if carried out, might result in the contamination of one of our priceless assets. Upon learning of the proposed Fort Lauderdale site I immediately contacted the Atomic Energy Commission protesting further consideration of this particular site. In response to my initial protest, I have received countless letters, wires, and phone calls from city officials, merchants' organizations and private citizens of that area, each offering encouragement and each voicing the same fear—that dangerous or not, there is so much doubt involved in such a program that the mere mention of Fort Lauderdale in connection with radioactivity might have dire effects on the economic well-being of the entire east coast area.

I have received verbal and written assurance from the Atomic Energy Commission that there are no present plans nor plans for the foreseeable future for dumping this waste off the lower east coast of Florida. What I would prefer to have is assurance that there will never be any radioactive waste matter disposed of in that area, studies as to suitability, notwithtsanding.

The admitted uncertainty as to the ultimate effect that such a disposal program might have on the area concerned together with innate danger of radioactivity itself, leads me to once again protest even the further consideration of the proposed Fort Lauderdale site.

Thank you again, Mr. Chairman and members of the committee, for permitting me the opportunity to transmit the feelings of the people I represent to the committee for its consideration.

Representative HOLIFIELD. Representative Dante B. Fascell also has submitted a statement for the record, and I will insert it at this point.

(Representative Fascell's statement follows:)

STATEMENT OF CONGRESSMAN DANTE B. FASCELL

CONGRESS OF THE UNITED STATES,
HOUSE OF REPRESENTATIVES,
Washington, D.C., July 29, 1959.

Hon. CHET HOLIFIELD,
Chairman, Special Subcommittee on Radiation,
Joint Committee on Atomic Energy,
Congress of the United States, Washington, D.C.

MR. CHAIRMAN: I strongly protest the proposals which are under consideration for disposing of atomic waste products in the water bodies of the earth. I feel that the possibility of contamination that we and future generations might suffer for this action is one which must be resolved to the complete satisfaction of the American people before any further disposal actions are authorized by the Atomic Energy Commission.

Notwithstanding scientific and technical testimony that there is no dangerous contamination, Mr. Chairman, doubt exists in the minds of Americans and other people of the world which is valid and reasonable. Community horror at recommendations of the National Academy of Sciences for dumping waste materials off the coast of south Florida is an example of the psychological effect which is being reflected by Americans at similar proposals. The dumping of the material in or near fisheries or tourist beach areas could prove disastrous to these multimillion-dollar industries in view of public wariness. Future plans for obtaining a large source of our food and water supply from the oceans could be affected since numerous areas for possible disposal have been used, more are under consideration for selection, and many more would be needed in the future.

I certainly recognize the beneficial effects of the uses of atomic energy and radiation; however, the program of disposing of atomic waste products needs more scientific attention. A different, inexpensive, neutralizing process must be found. Our health and the well-being of future generations are at stake; and it is our responsibility to determine to our complete satisfaction that we are not creating more future problems.

The consideration which this subcommittee is devoting to this question is commendable, essential, and will be of inestimable value in helping the public to deal with something of which it has a definite fear and uncertainty.

I submit that, in principle, it is just as erroneous to risk the possibility of dissipating contamination in water as it is in air or land. We have made analogous errors in the past. Just note what it is costing us today to attempt to correct the adverse effects of smog and water pollution. What will be the cost in the future to rid ourselves of the much more potentially dangerous accumulated atomic pollution in the air, land, and water, if ever, indeed, we can.

DANTE B. FASCELL, *Member of Congress.*

Senator PASTORE. Mr. Chairman, I have a statement here that I have been requested by Congressman Forand to insert in the record.

Representative HOLIFIELD. The Chair will receive it, and it will be printed.

(Congressman Forand's statement and a resolution by the council of the city of Newport, R.I., follows:)

RADIOACTIVE WASTE DISPOSAL INTO ATLANTIC AND GULF COASTAL WATERS

Mr. Chairman, initially I want to thank this committee for allowing me to appear on a matter of grave concern to Rhode Islanders. I am well aware of the important work this committee is engaged in. As you know, I was one of the original members of this committee.

Although, I am no longer a member, I feel quite secure that Rhode Island interests are being protected by my colleague and very eminent member of this committee, Senator John O. Pastore.

I am certain that this committee is well aware of the technical and scientific aspects of radioactivity and its effect upon the human body, and I am aware of the hearings that your committee has held on this subject.

Your concern is gratifying to me and my constituents. I would like, however, to register my objection to the manner and method of disposition of radioactive

waste as recommended by the study group under the auspices of the National Academy of Sciences, particularly, as it pertains to locations in the area of Rhode Island.

Upon examination, I found that one of the sites was an unused explosives dumping area, lying in a prohibited area and used by the Navy for practice bombings. Gentlemen, I can fully appreciate the necessity for locating areas for the dumping of this radiactive waste, but the placing of this waste upon unexploded bombs and powder is an act which "tempts the Devil himself." I have asked the Department of the Navy to supply me with information on this dumping area and the possible effects that these bombing practices would have upon these waste drums.

Rhode Island has been declared a labor surplus area for some years. We saw our economy shaken by the mass migration south of our textile industry—the industry that was once the backbone of our economy. With this industry gone, Rhode Islanders are promoting Rhode Island as the recreational area of the Northeast—which it certainly is. We have embarked on national campaigns and spent large sums of money enticing people to our surf waters and the wealth of our fishing spots, and have been successful in both these ventures. We have not stopped promoting, and plans for long range facilities in this area are in the making with more money considered for these projects.

The psychological effect upon the tourists and residents alike who have been traveling to our beaches will be disastrous to our programing. Radioactivity, in any degree, is a terrifying word, and even assuming that these waste drums were never disturbed or broken, the thought of their presence will jeopardize the very existence of our recreational industry.

Mr. Chairman, your committee is meeting today to discuss this problem of radioactive waste disposal. However, I feel we are approaching this problem from the rear. The primary consideration should not be where can we dump this waste most economically, but rather, where can we dispose of this waste and still secure the safety of the people and avoid the wrath of the various States voicing opposition to this committee. We must not gamble on uncertainty, nor place ourselves in a position where perhaps some day this problem might come back to haunt us. Any hasty decision now would be irreversible—once a problem developed that we had not foreseen.

What disturbs me most is the cost factor that appears to be uppermost in the minds of the men who drafted these recommendations in the dumping of this waste hundreds of miles from the shoreline of the continental United States. We are now spending billions for military defense. Certainly, we can spend a little more to protect ourselves from within. If the facts bear out the findings of this group I am sure no taxpayer would mind the payment of this money for disposing of this material—certainly it is worth it for the peace of mind. If, however, they are proven wrong billions of dollars would not make us whole again.

Too little is known of the long-term effects of radiation, and to date there is no defense against it once it has permeated our bodies. I sincerely hope this committee will proceed with caution in adopting any measure that deals with this question of radioactive waste disposal.

In conclusion, gentlemen, I want to go on record as endorsing a bill introduced by Congressman Clark W. Thompson of Texas. Mr. Thompson has taken a very rational approach to this disposal problem. In considering this bill the committee should recognize the maximum safety it affords at this time commensurate with our existing knowledge of radioactivity and its effects.

In discussing this bill with Mr. Thompson, general agreement was reached in not restricting this bill to the Gulf of Mexico only, but the application should be in all other areas bordering the continental United States.

Unless another approach has been suggested, Mr. Chairman, I wholly endorse the principle of this measure.

Thank you, Mr. Chairman, for the opportunity you have given me to present to your committee the views of my constituents on this important subject.

RESOLUTION OF THE COUNCIL OF THE CITY OF NEWPORT, No. 163–59

Whereas the council of the city of Newport has been alarmed by reports that sites for dumping radioactive wastes near the city of Newport have been considered by Federal authorities; and

Whereas the close proximity of those designated dumping places may have a most harmful effect on the coastal waters, the fish, crustacea, and other edible seafood; and

Whereas Newport is one of the leading resort cities in America where bathing, boating, and fishing are our most precious assets; Now, therefore, be it

Resolved, That the council of the city of Newport hereby protest vigorously at this attempted action and authorizes and directs that certified copies of this resolution be forwarded to the Chairman of the Atomic Energy Commission and the members of the Rhode Island delegation in the Congress.

In council read and passed July 22, 1959.

A true copy attest:

[SEAL] JOHN F. FITZGERALD, *City Clerk.*

[From the office of Congressman Aime J. Forand]

Attached is the reply Congressman Forand received from the Department of the Navy in answer to the following questions asked concerning the dumping of radioactive waste in the waters off the Rhode Island coast.

Congressman Forand said "he was delighted by the Navy's position that the present sites would be 'unacceptable' to them and I intend to make this known to the Joint Committee on Atomic Energy to be included in their study of this problem."

QUESTIONS PROPOUNDED

1. In view of the naval installations in the area, what is the Navy's position in this matter?

2. How many unexploded depth charges or torpedos in the area? What are their positions?

3. One of the proposed areas lies in a prohibited area used by the Navy for practice bombings. What are the positions of these bombing areas and, in your opinion, what effect would these bombings have upon the drums of radioactive waste?

DEPARTMENT OF THE NAVY,
OFFICE OF THE CHIEF OF NAVAL OPERATIONS,
Washington, D.C., August 6, 1959.

Hon. AIME J. FORAND,
House of Representatives, Washington, D.C.

MY DEAR CONGRESSMAN FORAND: Your letter of July 24, inquiring into areas for the disposal of radioactive waste, was referred to me for reply.

Insofar as disposal of radioactive waste by or for the Navy is concerned, the locations cited in your letter would be unacceptable. The Navy's practice has been to follow the recommendations of Bureau of Standards Handbook 58, which, in general, provide for jettisoning radioactive wastes in not less than 1,000 fathoms of water.

With specific regard to your questions:

1. Provided the radioactive waste materials are properly prepared and/or packaged for disposal by burial at sea it is not believed that disposal of these materials in the locations indicated would have deleterious effects in the Narragansett Bay area.

2. There are many unexploded depth charges, bombs, projector charges, and other explosive units in the general area south of Narragansett Bay. Some have been charted, but the vast majority have not. Of the locations mentioned in your letter, two appear to coincide with, or be contiguous to, areas wherein certain unexploded ordnance has been dropped. In comparison with the water areas involved, however, the numbers of unexploded items would be almost infinitesimally small, and this "dilution," coupled with the effects of salt-water corrosion on the material itself, would, in our opinion, completely obviate the possibility of damage to radioactive waste packages by unexploded ordnance.

3. Drums of radioactive waste actually contain very small amounts of the material, encased in several hundred pounds of concrete. The bombs dropped in the practice bombing areas are primarily subcaliber or water/sand fillable practice models, with only a few ounces of a spotting explosive in them. The Navy does not conduct practice bombing operations with full-scale bombs in the water areas under consideration. The material used for Navy practice could under no circumstances offer any threat of damage to drums of radioactive waste.

I trust that the above information will be useful to you. We are most happy to be of assistance, and we will try to furnish, without delay, any further data you may require.

Sincerely yours,

E. W. GRENFELL,
Rear Admiral, U.S. Navy,
Assistant Chief of Naval Operations (Logistics).

Representative DURHAM. Mr. Chairman, I have a resolution which I would like to submit for the record.

Representative HOLIFIELD. It will be received.

(The resolution and associated correspondence follow:)

STATE OF NORTH CAROLINA,
DEPARTMENT OF CONSERVATION AND DEVELOPMENT,
Raleigh, N.C., July 28, 1959.

Hon. CARL T. DURHAM,
House of Representatives,
Washington, D.C.

DEAR CARL: I have just completed a telephone conversation with Congressman Lennon who tells me that there will be a hearing tomorrow afternoon at 2 p.m., and also on Thursday, on the subject of dumping radioactive waste into the Atlantic and gulf coastal waters.

We would appreciate your entering into this hearing a copy of the resolution passed by the board of conservation and development at Morehead City. The entire membership of this board expressed the desire to know without a doubt that there would be no harmful effects to the fish life and the health of individuals before they would be in favor of any type of waste disposal into the coastal waters of North Carolina.

With kindest personal regards, I am,

Sincerely,

WILLIAM P. SAUNDERS.

CONGRESS OF THE UNITED STATES,
HOUSE OF REPRESENTATIVES,
Washington, D.C., July 29, 1959.

Mr. WILLIAM P. SAUNDERS,
Director, State Department of Conservation and Development,
Raleigh, N.C.

DEAR BILL: I appreciate very much your letter of July 28, and enclosure of the resolution passed by the board of conservation and development with respect to the disposal of radioactive waste into the Atlantic and gulf coastal waters.

Hearings on this subject begin this afternoon, and in accordance with your request, I will make this resolution a matter of record in the hearings.

With kindest and best regards, I am,

Sincerely yours,

CARL T. DURHAM.

RESOLUTION SUBMITTED BY THE COMMITTEE ON COMMERCIAL FISHERIES AND ADOPTED BY THE NORTH CAROLINA BOARD OF CONSERVATION AND DEVELOPMENT AT ITS MEETING IN MOREHEAD CITY ON JULY 13–14, 1959

Whereas the coastal waters have been and are an important commercial fishing area and contribute greatly to the economy of eastern North Carolina; and

Whereas the coastal waters of North Carolina are being developed as one of the largest sport fishing areas on the eastern seaboard; and

Whereas areas currently being used for radioactive industrial waste dumping have shown a decline in the production of commercial and sport fishing; and

Whereas long-range development plans indicate the use of coastal North Carolina areas for salt water conversion installations: Now, therefore, be it

Resolved, That the Board of Conservation and Development of the State of North Carolina stridently opposes the dumping of radioactive industrial waste materials in any area that would adversely affect the commercial and sport fishing and any other economic or recreational enterprises, and authorizes the director of the department of conservation and development to furnish a copy

of this resolution to each member of the North Carolina congressional delegation in Congress and to appropriate Federal agencies.

Representative HOLIFIELD. The Chair will say that while there is no legislation before us at this time, I understand Congressman Clark Thompson of Texas has a bill which has been referred to the Joint Committee, and also Congressman Bennett of Florida. It is my understanding that in your statement you will comment on this legislation.

General LUEDECKE. Yes, sir; one one bill, H.R. 8187.

Representative HOLIFIELD. Congressman Thompson's bill.

General LUEDECKE. I believe this is correct.

Representative HOLIFIELD. They are both identical. One is Atlantic and one is the gulf. That is the only difference.

You may proceed, General Luedecke.

STATEMENT OF GEN. A. R. LUEDECKE, GENERAL MANAGER, ATOMIC ENERGY COMMISSION; ACCOMPANIED BY JOSEPH A. LIEBERMAN, CHIEF, ENVIRONMENTAL AND SANITARY ENGINEERING BRANCH, DIVISION OF REACTOR DEVELOPMENT; HAROLD L. PRICE, DIRECTOR, DIVISION OF LICENSING AND REGULATION; CURTIS A. NELSON, DIRECTOR, DIVISION OF INSPECTION; AND ROBERT LOWENSTEIN, OFFICE OF GENERAL COUNSEL, ATOMIC ENERGY COMMISSION

General LUEDECKE. Thank you, Mr. Chairman.

The Atomic Energy Commission is pleased to have this opportunity to present this statement regarding its programs relating to disposal of low level radioactive wastes into the oceans. In our statement today we shall discuss briefly our plans concerning the recent report of the National Academy of Sciences-National Research Council, publication No. 665, entitled "Radioactive Waste Disposal Into Atlantic and Gulf Coastal Waters." We shall also describe generally the kinds of radioactive wastes which have been disposed, or are under consideration for disposal, into the oceans; the conditions and limitations which the Commisison has imposed on such disposals to insure protection of the health and safety of the public and its natural resources; the kinds of disposals which have been made into the oceans from Commission operations and the disposal activities of Commission licensees.

We shall also refer to the Commission's research and development programs pertinent to the sea disposal of radioactive wastes. Finally, as requested by the Joint Committee on Atomic Energy, we shall comment briefly on H.R. 8187.

At the outset, it should be emphasized that the primary objective of the Commission with respect to sea disposal operations is to assure the protection of man and his natural resources.

Publication of the NAS-NRC report appears to have led to a misconception that the Commission would approve the suggested sites for immediate use. There is no urgent requirement for inshore disposal sites. The Commission has no intention of designating any such site in the future without first thoroughly investigating, with the assistance of other interested Federal and State agencies, the physical and biological conditions of the area, as recommended by the NAS–NRC Committee.

It is emphasized that the Commission has not made a decision to use or approve the use of these inshore sites, even if the results of the studies and investigations are favorable from a safety standpoint. Such decision is a question for future consideration.

In addition, if a site were definitely established as suitable for use as a disposal ground without endangering the health and safety, the Commission would not license the commercial use of the site without providing an opportunity for a public hearing on the matter, as required by its rules of practice.

The NAS-NRC Committee study and report was requested and sponsored by the Bureau of Commercial Fisheries, Office of Naval Research, and the Atomic Energy Commission. The nature of the request was to examine the feasibility of disposing of the low-level wastes closer to shore than the 1,000 fathom disposal sites used by AEC. Feasibility was considered primarily from the point of view of safety. The study group considered inshore areas as safe for disposing of solid or packaged, low-level wastes up to 250 curies per year of the most biologically significant isotope without causing any adverse effect on man, provided proper precautions are taken in assessing and utilizing the sea disposal sites. We understand a representative of the NAS-NRC Committee is here to testify today in detail concerning the report. We believe that the report has furnished much useful and needed information on this subject.

In anticipation of a possible need for a coastal disposal site in the New England area where there is a relatively heavy concentration of industrial, medical, university, and other users of radioisotopes, the Commission is making arrangements to conduct field investigations of four Atlantic Ocean areas off the New England coast to determine if a specific site could be designated, when needed, for the safe disposal of small quantities of low level radioactive wastes and to establish the conditions under which such wastes could be deposited at the site.

Representative HOLIFIELD. At this time, would it be possible for you to describe what you mean by "low level," or ask one of your associates to explain the term.

General LUEDECKE. May I ask Mr. Lieberman to give you the definition, Mr. Chairman?

Mr. LIEBERMAN. Mr. Chairman, in the context of the subject matter of the hearings, we are thinking of wastes that have a concentration of radioactivity in the range of a millicurie or less per gallon. This is contrasted with the wastes that are associated with the chemical reprocessing of irradiated fuels where in a single gallon you might have hundreds or thousands of curies of radioactivity. In other words, as far as concentration of radioactivity is concerned, there is a factor of difference of literally tens of hundreds of millions involved here. As I recall in the NAS-NRC report, this definition is essentially the same. They are considering wastes that have a concentration of radioactivity of the order of a millicurie per gallon or less. That is a thousandth of a curie as compared to the high level wastes from chemical processing which would have hundreds or thousands of curies per gallon.

Senator PASTORE. If the Congressman will yield for a question or two, let us reduce this to understandable language on the part of the lay people who do not know exactly what a curie is, or one-thousandth

part of a curie might be. Would you describe some of the articles that we propose to dispose of in this highly congested area in New England?

Mr. LIEBERMAN. Yes. I think this will be covered in General Luedecke's statement.

Senator PASTORE. Am I anticipating somewhat in this?

Mr. LIEBERMAN. These are described later on.

Senator PASTORE. I will withhold my question.

Representative HOLIFIELD. Mr. Durham.

Representative DURHAM. Since you are expert in the field, how would that compare with hospital wastes, doctors' office wastes that are daily being put in the ashcans in every section of the country, and also waste from dental offices? How would that compare with a millicurie? That is one of the things we forget about. We have been disposing of this waste material for years and years and have not paid much attention to it. Now we are conscious of it.

Mr. LIEBERMAN. The nature of these wastes is such that they are primarily associated with the use of radioactive materials in research and development whether for biological, medical, or industrial purposes.

Representative DURHAM. It is in the hospitals, doctors' offices, and dental offices, and it is being distributed today in the ashcans.

Mr. LIEBERMAN. The other way I would make the statement, sir, is that in every phase of this atomic energy business where radioactive materials are going to be used, there are going to be wastes associated with these uses.

Representative DURHAM. You could not compare it on a millicurie basis because you have no knowledge of what is being disposed of in hospitals where it is being used in a dozen different ways.

Mr. LIEBERMAN. They are subject to licensing and control by the Commission.

Representative DURHAM. Not the waste disposal?

Mr. LIEBERMAN. Yes, sir. What they do with these wastes—that is, the users of isotopes—are subject to the control of the Atomic Energy Commission in what is done in the way of disposal.

Representative PRICE. What do they do with them now?

Mr. LIEBERMAN. For the short half-lived wastes, for example, something like iodine, they can hold onto it until it decays away. There are also licensed commercial waste disposers that are licensed to collect, package, and dispose of these wastes from various isotope users. In some cases isotope users have been shipping some of these wastes—under a sort of a grandfather arrangement—back to Oak Ridge for burial.

Representative HOLIFIELD. Mr. Hosmer.

Representative HOSMER. I would like to get further into this concept of what we are talking about here. When you are talking about a millicurie per gallon, how would that be packaged?

Mr. LIEBERMAN. All of these wastes—and this also is covered in the testimony, but just briefly—all of these wastes are packaged, in a way that they can be safely handled, transported, and will sink in the sea.

Representative HOSMER. I am trying to get the package.

Mr. LIEBERMAN. The final package is in most cases a 55-gallon drum but only about a third or a half of the volume is actually waste material.

Representative HOSMER. You get down to the point where you have about one twenty-fifth of a curie concentrated.

Mr. LIEBERMAN. The average concentrations and the average quantities of radioactivity per package are covered in the testimony.

Representative HOSMER. We are trying to get a concept of what it means in relation in standing next to the container. What kind of exposure would you get?

Mr. LIEBERMAN. In most of these cases the quantity of radioactivity involved does not require shielding. Nevertheless, concrete is part of the package for weighting purposes.

Representative HOSMER. In other words, you could stand up against it all day long and it would not hurt you?

Mr. LIEBERMAN. That is correct.

Representative HOSMER. You are talking about disposing of something that you can't get hurt with anyway.

Mr. LIEBERMAN. As far as an individual package is concerned. If you let all this stuff accumulate in one place and handle it indiscriminately, it conceivably could eventually create a hazard. As far as the individual packages are concerned, this is correct. In the case of the licensed operations, they have to meet ICC requirements for shipping so there will not be overexposure to radiation.

Representative HOSMER. But the quantities here are harmless in packages.

Mr. LIEBERMAN. That is correct, sir, as individual packages.

Senator PASTORE. You mean by that provided that this concrete is never broken, that the container is never broken, that it never comes to exposure. That is what you are talking about.

Mr. LIEBERMAN. Yes, sir.

Senator PASTORE. I do not think we ought to leave the impression here that you could hold all this material in your hand, you could swallow it if you wanted to, and it would not do you any harm. Is that the impression you want to leave here?

Mr. LIEBERMAN. No.

Senator PASTORE. Of course not. We are dealing with a dangerous substance, unless it is properly handled.

Mr. LIEBERMAN. That is right.

Senator PASTORE. Let us keep this in proper perspective.

Representative HOSMER. Assuming a breakage of the container in such a place as the ocean bottom, however, the concentration would become less rather than greater?

Mr. LIEBERMAN. That is correct, sir.

Senator HICKENLOOPER. This may be covered in your testimony later, but we have as a matter of fact ever since we started this atomic project for the last 15 years or so been conducting constant experiments in biological life, fish, and various other types of life, by exposure to radiation, haven't we that is keeping fish in radioactive water, and things of that kind? Has there been any ascertainable change, alteration, or defect of any kind upon fish life over many generations of fish that have lived constantly in concentrations that are greater than one millicurie per gallon of general radiation?

Mr. LIEBERMAN. I am not an ichthyologist. I have not been directly concerned with the studies that I think you are referring to. These were carried out primarily at Hanford.

Senator HICKENLOOPER. They have been going on constantly?

Mr. LIEBERMAN. At Hanford and other places. To my knowledge in any of the AEC disposal operations, there has not been any deleterious effect on the fish life due to radioactivity.

Senator HICKENLOOPER. If you are not familiar with the results, there is no use pursuing it. We will talk to someone who is connected with it.

Mr. LIEBERMAN. The point I make here is that I cannot relate the results of specific experiments and specific concentrations of radioactivity to effects on fish.

(Statement concerning above discussion prepared by AEC follows:)

STATEMENT ON BIOLOGICAL EFFECT OF RADIATION ON FISHES

Prepared by the Atomic Energy Commission

This statement is presented in response to a question concerning the biological effect of radiation on fishes living in an environment equivalent to 1 millicurie per gallon of wastes. Of concern was whether packaged radioactive wastes are harmful to fisheries and to humans.

Although the Commission has been supporting research related to this problem since 1943, the direct effects if any, of very low level exposure to radiation are extremely difficult to establish. We are convinced that few if any such effects could occur from packaged wastes. This opinion is based on the same evidence that was considered by the National Academy of Science Committee that prepared publication 655 which convinced that Committee that the disposal of packaged wastes as presently conceived in inshore waters would create essentially no hazard.

Although various perameters may be established to perform research on the effects of wastes, many considerations remove such research from the immediate practical problems in nature. Since it is extremely difficult to do appropriate research at the bottom of the ocean, I shall mention some of the considerations that must be delineated in the performance of laboratory research.

A factor to be considered is the habits of the fishes themselves. Marine fishes are migratory. Most commercial species spawn in the open water and swim about depending on the vagaries of water currents, water temperature, available food, and whatever whims may be assumed to an animal of such low intelligence. In no realistic case do fishes live in one place for generation after generation. Although this is a statistical possibility it is so unrealistic, that there have been no long-term studies to confirm the hypothesis of effects. The very fact that fishes are migratory makes them accumulate as adults in certain places, sometimes predictable for harvest in commercial quantity.

Another series of considerations have to do with the concentration, "1 millicurie per gallon." Many values must be assumed in order to convert this to research. Isotopes vary in length of time when they could produce damage, i.e., they disintegrate sponstaneously at a predictable rate (half life). They vary in their acceptance by a biological systems (biological half life). The energy of irradiation varies from very damaging gamma rays to particles that may be completely stopped by a thin sheet of paper. It matters greatly whether the irradiation source is eaten or not. The radiation danger from one isotope may be many orders of magnitude less than that from another.

General Leudecke gave an idea of the latter type of variation when he said "the relationship of tritium to, for example, strontium, is a relationship of 250,000 to 1." Various isotopes emit alpha, beta, and gamma radiation. Each type of radiation varies in intensity and thus in effect on all kinds of living things. One can try experiments with individual isotopes and with isotope mixtures as they may occur in waste packages but no standard value is obtainable without the expenditure of many scientific man-years and even then the averages are deceptively meaningless.

Realistically the exposure of fishes generation after generation to "1 millicurie per gallon" has no meaning. The maintenance of radiation equal to 1 millicurie per gallon could only be accomplished by continuously adding radioactive material to replace the decaying isotope. In practice no packaged waste could continue to add isotope at a constant rate for a significant period of time. Diffusion of an isotope from the surface of the container would result in its dilution. A fish swimming through the adjacent water would alter the computations significantly by increasing the rate of diffusion.

Table III in NAS publication 655 gives a concept of the half life of several more commonly used isotopes under packaged conditions. It may be noted that only a few isotopes may still be present in significant quantities after a period of years. A similar table, prepared for isotopes produced by atomic testing, is attached to this report (table 1). After the University of Washington studies of the conditions in and around that Pacific test site they have concluded (Seymour, fallout hearings, May 1959) that the isotopes Cesium 137 and Sr^{90} are relatively unimportant in the ocean as compared to land while Zn^{65}, Co^{60}, Mn^{54}, and Fe^{55} are found in marine animals. The latter isotopes are relatively short lived. Such statements relate to the biological half life of an isotope. Only certain isotopes are absorbed or adsorbed by fishes. A few isotopes are related to normal food chemicals and thus are absorbed readily and may produce internal effects. Although some isotopes are concentrated in this manner, some isotopes are strongly discriminated against. Such factors as length of digestive tract, rate of feeding, palatability of waste chemicals, etc., are uncertain but significant factors to evaluate. The usual types of waste, i.e., charred clothing and cellulose wastes, contaminated metal, broken glass, etc., are not likely to be chosen as food.

Another problem lies in the difficulty of assessing minimal damage to a fish. Pathological changes may appear at a higher irradiation rate than genetic changes. Our present knowledge of the normal fish in the ocean is so meager that it is extremely difficult to recognize slight genetic changes. A codfish may produce 2 million eggs. For a period of time the eggs and newly hatched young are preyed upon by many species of fish, including, at times, the parents. Weakened animals at any stage become food for others. The chance of survival of an individual codfish egg to adulthood is slight. The addition of a genetic factor may be quite unimportant under these circumstances, or it may be significant if it survives. How can we be sure that the genetic factor appeared as a result of radiation?

A method of coping with the above considerations is to assume a pure isotope in a constant concentration and to assume a fish in a trap adjacent to a waste package. Both of these assumptions probably err by several orders of magnitude in the direction of safety. The National Academy of Science makes this type of assumption and on page 28 of their report (No. 655) is given a table of permissible concentration factors that can be computed on this basis.

Research related to the problems listed previously has been underway at the Hanford laboratories of the AEC since their inception. Basically, all of the Commissions research on the oceans may be applied to the above problems. All work on the biology of marine organisms sheds at least some indirect light. The problem is the subject of a 135-page report by the National Academy of Sciences (publication No. 551) in 1957. A few other pertinent publications are listed as the attached bibliography.

TABLE 1.—*Percent of total radioactivity contributed by certain fission products of biological interest at different times after fission*[1]

	20 days	90 days	1 year	3 years	10 years	20 years
Sr^{89}	5.0	10.5	2.7			
Sr^{90}, Y^{90}			3.7	17.4	44.0	48.0
Y^{91}	5.6	12.5	3.8			
Zr^{95}	5.9	14.7	7.2			
Nb^{95}	2.3	18.0	14.7			
Mo^{99}	1.3					
Ru^{103m}	4.4	7.2	.8			
Rh^{103}	4.2	7.0	.8			
Ru^{106}, Rh^{106}			4.9	6.0		
I^{131}	5.6					
I^{132}	1.1					
Cs^{137}, Ba^{137m}			2.9	13.6	36.0	45.0
La^{140}	13.9	1.8				
Ba^{140}	12.0	1.6				
Ce^{141}	9.7	8.5				
Pr^{143}	12.0	11.2	2.6			
Ce^{144}, Pr^{144}	2.6	12.0	52.8	42.0		
Nd^{147}	5.0					
Pm^{147}			5.7	19.0	16.0	3.4
Sm^{151}				1.1	2.5	2.6

[1] Adapted from data of Hunder and Ballou (1951). Reference, Chipman (1958).

1. National Academy of Sciences/National Research Council, 1957, "The Effects of Atomic Radiation on Oceanography and Fisheries," NAS–NRC Publications N. 551.

2. National Academy of Sciences/National Research Council, 1959, "Radioactive Waste Disposal into Atlantic and Gulf Coast Waters," NAS–NRC Publication No. 655.

3. Seymour, A., 1959 "Fallout in the Ocean," a statement prepared for the Special Subcommittee on Radiation, Joint Committee on Atomic Enery, Congress of the United States, for public hearings on fallout from nuclear weapons tests, May 5–8, 1959.

4. Hsio, S. C., 1957, "The Uptake of Radioactive Calcium by Sea Urchin Eggs," proceedings, Hawaiian Academy of Sciences, 32d annual meeting, 1956–57.

5. Bonham, K., 1958, "Radioactivity of Invertebrates and Other Organisms at Eniwetok Atoll During 1954–55," University of Washington, UWFL–53.

6. Rice, T. R. and R. J. Smith, 1958, "Filtering Rates of the Hard Clam (*Venus mercenaria*) determined With Radioactive Phytoplankton," U.S. Department of the Interior Fishery Bulletin, volume 58, No. 129.

7. Rice, T. R., 1954, "Biotic Influences Affecting Population Growth of Planktonic Algae," U.S. Department of the Interior Fishery Bulletin, volume 54, No. 87.

8. Rice, T. R., 1953, "Phosphorus Exchange in Marine Phytoplankton," U.S. Department of the Interior Fishery Bulletin, volume 54, No. 80.

9. Pendleton, R. C., and W. C. Hanson, 1958, "Absorption of Cesium 137 by Components of an Aquatic Community," Second U.N. International Conference on the Peaceful Uses of Atomic Energy.

10. Ophel, I. L., 1958, "The Disposal of Radioactive Wastes," Atomic Energy of Canada, Ltd., Chalk River, mimeographed.

11. Boroughs, H., S. J. Townsley, and R. W. Hiatt, 1957, "The Metabolism of Radionuclides by Marine Organisms III. The Uptake of Calcium 45 in Solution by Marine Fish. Limnology and Oceanography II" (1) : 28–32.

12. Chipman, W. A., 1958, "Biological Accumulation of Radioactive Materials," proceedings, First Annual Texas Conference on the Utilization of Atomic Energy, A. & M. College of Texas, March 31–April 2, 1958.

13. Chipman, W. A., 1958, "Accumulation of Radioactive Materials by Fishery Organisms," paper presented at the 11th annual meeting of the Gulf and Caribbean Fisheries Institute, November 17–21, 1958, at Miami Beach, Fla.

14. Foster, R. F., 1958, "Need for Biological Monitoring of Radioactive Waste Streams," Nuclear Engineering Conference, Cleveland, April 1958.

Senator HICKENLOOPER. It is my understanding that concentrations greatly in excess of a millicurie per gallon have been the environment in which fish have lived for generation after generation, reproduced and exposed to cencentrations far greater than 1 millicurie per gallon, and there has been no noticeable alteration or change or defect or effect on fish. The same thing is true of other biological species. Manifestly, you can get up to a point where effect is noticeable with great concentrations.

Senator PASTORE. If the Senator will yield for a question on that very point, are you prepared to say then if one of these containers should become disintegrated in one of these sites which has just been pointed out by Congressman Casey, which is a site about 25 miles away from the shore, that substance is released and fish in that area came in contact with that substance, and then an individual ate that fish, that no harm would come to the individual? Can you categorically make that assertion here today?

Mr. LIEBERMAN. Sir, personally, I think I would be willing to make that assertion. But I would also defer to the judgment of some of the oceanographers here. Also, I think I would defer a categorical answer to this question to other information and to the studies that the NAS–NRC group indicated should be made.

Senator PASTORE. That is precisely the point I make. We need further studies before we could categorically answer the question I put to you.

Mr. LIEBERMAN. There is available information on the concentration of radioactive materials by fish and the dilution and dispersion by ocean currents. Dr. Carritt could probably answer this question much better than I. As far as the kind of wastes involved in an individual package, it is difficult for me to conceive of a situation where if a package broke up, and a fish were exposed and a person ate that fish, that he would be harmed by the quantities of radioactivity involved.

Senator PASTORE. Mr. Luedecke, are we going to have testimony on that subject before this committee from the AEC? Let me ask you this question: Are we prepared to produce before this committee scientific evidence to bear out the assertion made by your assistant?

General LUEDECKE. We are not today. That is the reason we want to make these studies. We make them a prerequisite.

Senator PASTORE. Is it fair for me to assume that much remains to be done in the way of research and study before we could definitely say what degree of harm is involved in this kind of a situation?

General LUEDECKE. Insofar as the Commission is concerned, I think it is fair to say that we want to get a lot more information about these particular places before we relate it to the subject you mentioned.

Senator PASTORE. The thing that gives me concern in this whole area is the fact that, as it strikes me, we are getting the cart before the horse. How can we pick out a site and say it is a desirable site unless we scientifically know the dangers involved? Aren't we getting the cart before the horse? Isn't it first necessary to determine what is the harm to fish life as related to man, who eats the fish, and then determine from that point on in what areas you can deposit this disposal? Isn't that the way to go about it? I think it is a fair question. I would like to get an answer.

Representative DURHAM. Would the Senator yield at that point?

Senator PASTORE. After I get my answer.

General LUEDECKE. Senator, we asked a committee to make a study of it. They have reached these conclusions and have submitted their report to the Commission. They did recommend that further study be made. It is on the basis of those further studies that the Commission will take its action.

Senator PASTORE. I realize that. The only reason I express this apprehension and concern is because it strikes me that at least one of the sites that has been talked about off the coast of Rhode Island is a former explosive dump. I hope we are not casually picking out these places that we have used for disposal of other materials, and then begin to justify the selection. I hope we determine scientifically first what is harmful and what is not harmful and then predicate upon that information and make a selection as to the site. In other words, don't find a dump first, and then try to find the reason why you can use that dump for this purpose. That is what I think you have done in Rhode Island. You first went out and found a dump that was used for explosives, and you said this is a good place to dump this atomic waste. Then you will justify whether it can be done or not. I say you are doing it in the reverse manner.

Representative DURHAM. Will the Senator yield?

Senator PASTORE. Yes, I yield.

Representative DURHAM. I think the general statement is perfectly clear on that point. No decision has been made.

Senator PASTORE. I realize that. We know a lot of decisions that were made later on, and we were caught by surprise. That is why we want all the evidence in here. I can read English. I realize the letter that Mr. Luedecke sent to me is to the effect that no final decision has been made. I can understand that. I am afraid if we don't investigate these things, we will find that the decision has been made without the knowledge of the members of the committee, a decision that might not prove to our liking. It is our responsibility to determine these things.

I realize that the AEC is not out to poison the people of America. I hope I am not creating the wrong impression here. The thing that did disturb me is that the site selected is off the coast of Rhode Island and is the site that was used for the disposal of explosives, and now because it is not being used for that purpose there and then added a saving phrase, somebody got the bright idea to dispose of atomic waste, but we will make an investigation. First you scare the daylights out of everyone then we will begin to assure them that it is all right.

General LUEDECKE. Senator, that was not the Commission's approach to that particular site. Since it was selected by the committee, I am sure they will testify to their method of selection when they testify.

Representative HOLIFIELD. I think we will cover a lot of these points if we let the general complete his testimony, and then we will question him. Go ahead, General.

General LUEDECKE. Thank you. The studies, to begin in September, will be conducted with the assistance of the Coast and Geodetic Survey, the Public Health Service, and scientists from the University of Connecticut. The AEC is financing all of this work.

The Commission does not presently contemplate investigating any other suggested Atlantic coastal areas because a need for their use is not foreseen in the near future. The Commission tentatively plan to investigate areas in the Gulf of Mexico some time next year. None of the suggested gulf locations have been designated for this study as yet.

After consultation with representatives of the NAS–NRC Committee, local representatives of the U.S. Fish and Wildlife Service and representatives of the Massachusetts Department of Public Health and Marine Resources, the AEC has eliminated from its consideration two of the inshore disposal sites in the New England area suggested in the NAS–NRC report because use of these areas might interfere with sport and commercial fishing activities. These sites are: A rocky ledge, known as Brown Ledge, 10 miles from Sakonnet, R.I., at 41°19.7′ N. and 71°063′ W., and a 2-mile diameter site in which unexploded depth charges have been dumped, located 10 miles from Point Judith, R.I., at 41°14′ N. and 71°25′ W.

Two of the four sites to be investigated were specifically suggested by the NAS–NRC Committee in its report. One of these sites is an area 2 miles in diameter, located in Massachusetts Bay, at 42°25.5′ N. and 70°35′ W, which has been used by the Crossroads Marine Disposal Corp. of Boston as a disposal ground for small quantities of low-level wastes. The company's license has been amended to require that as of August 15, 1959, it carry out its disposal operations in deep waters off the Continental Shelf, at two locations—one 150 miles southeast of Sandy Hook, N.J., and the other 200 miles off Cape Cod.

The other site is an explosive dumping area, 10 miles by 10 miles, located 45 miles from Sakonnet Point, R.I., at 40°45′ N. and 70°52′ W.

The other two sites were not identified in the NAS–NRC report but were suggested after consultation with the NAS–NRC Committee, local representatives of the U.S. Fish and Wildlife Service, and representatives of the Massachusetts Departments of Health and Marine Resources, for further investigation. They are near sites included in the NAS–NRC report. One site is a 10-mile by 10-mile area known as no man's land. This is an area already restricted and used as a Navy gunnery range. It is approximately 12 miles south of Martha's Vineyard at 41°15′ N. and 70°43′ W. The other is an area reported to be devoid of biological life located approximately 15 miles east of South Wellfleet, Mass., at 42°05′ N. and 69°46′ W.

The Coast and Geodetic Survey will take samples and make measurements to evaluate the dispersing effect of tides and currents and the uptake of radioactivity by clays and silts and by biological systems. The biological sample gathering will be carried out in collaboration with Dr. John S. Rankin, marine biologist of the University of Connecticut. The water supply and water pollution control group of the Public Health Service Robert A. Taft Sanitary Engineering Center at Cincinnati, Ohio, will make measurements of radioactivity in the biological and sediment samples to determine background radiation conditions.

After the field data have been gathered and analyzed the Commission will convene a group of marine scientists to evaluate the results. In the course of the evaluation other Federal and State agencies having an interest in the matter will be consulted.

Representative HOLIFIELD. Do you mean by this that before any such site is approved that you will consult with the State agencies that have responsibility in the field of health and safety protection?

General LUEDECKE. That is correct, sir.

Senator PASTORE. What if that agency does not approve?

General LUEDECKE. This would be a factor for consideration by the Commission and would become a factor in the public hearing on the matter if the Commission still felt it was safe to go ahead and it should go ahead.

Senator PASTORE. In other words, even if they did disapprove and you were of the mind that you could go ahead, you would go ahead nonetheless?

General LUEDECKE. No, sir; I did not intend to say that. I said that would be another matter for consideration by the Commission in granting the license.

If one of these inshore disposal sites is approved, periodic monitoring of the site would be carried on in order continuously to assure that the capacity of the site to receive these radioactive materials safely is not exceeded.

Representative HOLIFIELD. In other words, you contemplate periodic monitoring of any of these sites by taking the sediment from the bottom and by using other types of measurement in order that you will at all times be sure that your maximum permissible level of radioactivity is not exceeded.

General LUEDECKE. That is correct. We would want to determine whether there was a buildup of radioactivity in the area as a result of the disposal operation.

Representative HOLIFIELD. Mr. Toll.

Mr. TOLL. Mr. Luedecke, you mentioned one site where disposal already has been made near Boston and the license is now being amended, is that correct?

General LUEDECKE. That is correct.

Mr. TOLL. How many disposals have been made at that site to date?

General LUEDECKE. May I ask Mr. Price to answer that question?

Mr. PRICE. I do not know the answer to how many disposals. There have been approximately 2,400 curies.

Mr. TOLL. Why is the license being amended to designate an area further away from the shore? Is it considered that there might be a hazard as a result of the curies already deposited in that area?

Mr. PRICE. No. This has a little bit of history to it. This license was set up under the authorization procedure of the 1946 act, and for a good many years this was the only commercial waste disposal operation. This operation got started in 1952. There have been periodic checks of the area and no evidence of radioactivity. The radioactivity has not been found. In the meantime within the past 18 months a good many other people have applied for licenses to go into the commercial waste disposal business. I say a good many—a half dozen or so. For all of those we have applied the criterion of the National Committee of Radiation Protection of 1,000-fathom depth. We told this man some months ago, or last winter, that he would have to make arrangements to move his operation so that he would be under the same criteria as the other people. We have no evidence that the quantities he was using were unsafe, but until this study was completed and further studies of inshore operations were completed, we thought we ought to discontinue this one inshore operation and put him on the same basis as all other commercial licensees until such time in the future as a decision is made on the whole problem of inshore disposal.

Mr. TOLL. Did you say what depth this area is?

General LUEDECKE. I think it is about 52 fathoms.

Mr. TOLL. You are currently applying a standard of 1,000 fathoms?

Mr. PRICE. Yes. This means off the Continental Shelf on all coasts, Pacific and Atlantic, and there is a case pending before the Commissioners for a hearing on the gulf. That is beyond the shelf, too.

Mr. TOLL. To that extent you concur with Congressman Thompson's bill which provides for 1,000 fathoms.

General LUEDECKE. We have been operating on all current licensing actions in the past couple of years under the 1,000-fathom criterion. Whether as a result of further studies it will turn out that it is not necessary to go that far, I have no way of answering. Right now it is the policy to apply the 1,000-fathom rule, which means off the Continental Shelf and it means anywhere from possibly 70 to 150 miles, depending on where the shelf is.

Mr. TOLL. Aren't a number of these NAS-suggested sites much less than 1,000 fathoms?

Mr. PRICE. Yes, that I think is what this committe is holding this hearing about. It is the question of what is going to be our approach

to some of these close-in sites, some of which are just 10 miles offshore.

Representative HOLIFIELD. I think it will be reassuring to the people to know that your licensing requirements are for dumping at the present time off the Continental Shelf.

Mr. PRICE. That is right.

Representative HOLIFIELD. This committee will keep this matter under our attention, and if there is any change in your policy, I am sure you will keep the committee currently informed.

Mr. PRICE. Certainly.

Senator PASTORE. May I ask a question on this point? Do you do monitoring with relation to the disposal in 1,000 fathoms?

Mr. PRICE. Mr. Lieberman could answer that better than I could, but I don't think there has been any substantial monitoring. There has been some in a couple of sites.

Mr. LIEBERMAN. We have made a survey of the site that the Atomic Energy Commission uses off the Atlantic coast in connection with its own operations.

Senator PASTORE. That is high level?

Mr. LIEBERMAN. We are talking about the same kind of solid packaged wastes. To answer your question specifically, to my knowledge there has not been montoring of all the sites that the licensees have been using.

Senator PASTORE. May I ask this question, then: As far as the economics involved are concerned, wouldn't it be necessary to do more monitoring where you are closer to the shore than if you got away beyond the Continental Shelf?

Mr. LIEBERMAN. It would probably be necessary to do more monitoring. It would be a lot easier and cheaper to do it. It is easier to do the kind of sampling I think would be required in a few hundreds of fathoms or tens of fathoms than it is in a thousand or 2,000 fathoms.

Senator PASTORE. Maybe you would not have to do any monitoring at all if you got down in deep oceanic water. If you got down to a thousand fathoms or beyond that.

Mr. LIEBERMAN. As I said, Senator, in the 1,000-fathom area, 150 miles off Sandy Hook, we have looked there. This was done in 1957 and we detected no radioactivity.

Senator PASTORE. The reason I asked the question is because there seems to be an element of economics involved as you read this report. It seems to be all predicated on the fact if you go out too far, it costs too much. I hope that is not the controlling consideration. I know it would not be with the AEC because uppermost in their minds would be public health. That is the impression that has generally been gathered from the report. The fact is that you keep repeating and repeating it is less expensive to do it this way. I don't think that is any consideration at all. The consideration is just this, the safety involved.

Representative HOLIFIELD. Before you resume your reading, General Luedecke, may the Chair recognize Congressman Kilgore, and Congressman Young of Texas, and ask them if they would like to file a statement now or within the next few days on the subject?

STATEMENT OF HON. JOE M. KILGORE, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Representative KILGORE. Thank you, Mr. Chairman. I would like to associate myself with the remarks the committee has already had from Congressmen Thompson and Casey. In that association, I would support the position they have taken. I think it would be unnecessary to intrude further on the committee's time, because they have stated generally the Texas gulf coast position.

STATEMENT OF HON. JOHN YOUNG, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Representative YOUNG. Thank you, Mr. Chairman. I too would like to join in the protest of Congressmen Kilgore, Thompson, and Casey, and state that in addition to the statement in the written statement of Congressman Thompson, I think the committee ought to consider the adverse psychological impact that such a disposal program might well have on the fishing industry of the areas involved, especially the Gulf of Mexico. Thank you very much, Mr. Chairman.

Representative HOLIFIELD. The Chair thanks the gentlemen.

Representative BATES. Mr. Chairman.

Represesntative HOLIFIELD. Congressman Bates.

Represesntative BATES. General, some 2 or 3 weeks ago I requested the staff to prepare a letter for the chairman's signature to Mr. McCone relative to this disposal area 22 miles out of Boston. I have not heard from that since that time. Is a letter coming up on that, or do you consider this to be the reply?

General LUEDECKE. No, sir; I do not consider this to be a reply. I sent the letter forward yesterday morning to the best of my knowledge, and it should be here.

Representative BATES. I got a telephone call it was coming, but I never received it.

I can look into it.

(The correspondence referred to follows:)

ATOMIC ENERGY COMMISSION,
Washington, D.C., July 25, 1959.

Hon. CLINTON P. ANDERSON,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States.

DEAR SENATOR ANDERSON: This replies to your letter of July 20, 1959, requesting the Commission's comments on one of the areas (described as area No. 1, located at 42°25.5′ N. and 70°35′ W., approximately 22 miles from Boston) suggested in the National Academy of Sciences, National Research Council Publication 655, as possible sites for disposal of radioactive wastes in the Atlantic Ocean.

The National Academy of Sciences study and report was requested and sponsored by the Bureau of Commercial Fisheries, Office of Naval Research, and the Atomic Energy Commission. The nature of the request was to examine the feasibility of disposing of the low-level wastes closer to shore than the 1,000-fathom disposal sites used by AEC. Feasibility was considered primarily from the point of view of safety. The study group considered inshore areas as safe for disposing of packaged low-level wastes up to 250 curies per year of the most biologically significant isotope without causing any adverse effect on man, provided proper precautions are taken in assessing and utilizing the sea disposal sites.

The Atomic Energy Commission has no present plans for using or approving the use of the inshore, shallow-water locations suggested in the report as possible safe low-level waste-disposal sites. In connection with the NAS Committee con-

clusions on the Atlantic and gulf coast locations, certain recommendations were made regarding preuse investigations. These recommendations include surveys of the areas prior to their use to determine details of local water circulation, inventory of the marine biota (especially bottom-level organisms), and background levels of radioactivity in order to establish specific operating criteria and assure safety. In accordance with these recommendations, the Atomic Energy Commission is entering into a cooperative arrangement with the Coast and Geodetic Survey and the U.S. Public Health Service and university scientific personnel to conduct field investigations of certain of the suggested coastal areas, and preliminary work is underway in areas off the New England coast. Upon completion of the field investigations, we will call on expert marine scientists for evaluation of the data collected.

Immediate attention is being given to the development of improved techniques for taking samples of bottom deposits and of marine life. The methods developed will be applied to surveys which may be conducted in the other designated areas at a later date as may be required. These surveys will include such things as measurements of ocean current, analysis of bottom organisms for background levels of radioactivity, and their relation to the nature and extent of commercial and sport fisheries that may exist within or near the areas. The timing and extent of these field studies is dependent on the availability of ship time from the U.S. Coast and Geodetic Survey and necessary funds. At the present time we are planning surveys of four areas off New England in accordance with the recommendations of the NAS report. These are located approximately as follows:

(*a*) An area 2 miles in diameter, located in Massachusetts Bay at 42° 25.5′ N. 70°35′ W., previously designated as "Foul Area, Explosives." This is the area referred to in your letter.

(*b*) An explosives dumping area 10 miles by 10 miles, 45 miles from Sakonnet Point, R.I., at 40°45′ N. 70°52′ W.

(*c*) A 10-mile by 10-mile area known as No Man's Land, an area presently restricted as a naval gunnery range, approximately 12 miles south of Martha's Vineyard, Mass., at 41°15′ N. 70°48′ W.

(*d*) A 10-mile by 10-mile area reported to be devoid of biological life, 15 miles east of South Wellfleet, Mass., at 42°05′ N. 69°46′ W.

It should be emphasized that the Commission has not made a decision to use or approve the use of these inshore sites, even if the results of the studies and investigations referred to above are favorable from a safety standpoint. This is a question for future consideration in the light of all pertinent facts.

The wastes considered for sea disposal contain low-level radioactivity. These wastes originate in research laboratories of hospitals, universities, industrial firms, and other places where radioactive isotopes are used for various purposes. The radioactive waste itself usually is in the form of contamination on equipment such as test tubes, bottles, rubber gloves, blotting paper, and rubber tubing. This trash is packaged within concrete in 55-gallon drums or in preformed, reinforced concrete boxes before disposal. High level radioactive materials which result from processing irradiated reactor fuel elements are not disposed of into the sea. They are, at the present time, being stored in specially designed, underground steel tanks at the places where they are produced—namely Hanford, Wash.; Arco, Idaho; Savannah River plant, South Carolina, and smaller quantities at Oak Ridge National Laboratory.

It should be noted that an AEC licensee has been using the area referred to in your letter ((*a*) above) since 1952 for the disposal of low-level waste derived primarily from industrial and research activities in the Northeastern States. This is an area which has been designated by the Corps of Engineers, U.S. Army, for the disposal of explosives and toxic materials. Some months ago the licensee was notified by the AEC staff that, in view of the 1,000-fathom criterion observed by the Commission in more recent sea-disposal licenses, he would have to seek a new disposal site off the Continental Shelf in at least 1,000 fathoms of water. This involved moving his shore base to a place suitable for storage between voyages and arranging for the use of a deep-sea vessel instead of a barge previously used. The licensee accordingly applied for an amendment to its license to authorize disposal at either of two designated sites located beyond the Continental Shelf and at a minimum depth of 1,000 fathoms, the closest of which is about 120 miles offshore. The license has been amended effective August 15, 1959, to require the use of these remote sites instead of the close-in site.

Sincerely yours,

A. R. LUEDECKE, *General Manager.*

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D.C., July 20, 1959.

Gen. A. R. LUEDECKE,
General Manager,
U.S. Atomic Energy Commission,
Washington, D.C.

DEAR GENERAL LUEDECKE: Congressman Estes has requested that the Commission forward comments to the Joint Committee on an area suggested by a recent National Academy of Sciences report as a possible site for disposal of radioactive wastes in the Atlantic Ocean near Gloucester, Mass. This area is identified as area No. 1 in figure 7 on page 34, and as No. 1 in table 6 on page 35, of the report by the NAS–NRC entitled "Radioactive Waste Disposal Into Atlantic and Gulf Coastal Waters" (publication 655).

It is requested that information be forwarded concerning the suitability of this site, in the opinion of the Commission, together with a summary of the safety procedures and protections that would be followed by the Commission if any wastes should be disposed of in this area.

Comments of the Commission are requested by July 24, 1959, if possible.

Sincerely yours,

CLINTON P. ANDERSON, *Chairman.*

Representative BATES. On these two other sites outside of Boston, you said the local representative of the Fish and Wildlife Service and representatives of the Massachusetts Departments of Health and Marine Resources have recommended these two additional sites. Is that what I understand your text to say?

Mr. LIEBERMAN. I don't think it is a question of their direct recommendation. This was in consultation with the representatives of the Fish and Wildlife Service at Woods Hole, and this was also discussed with the representative of the Massachusetts Departments of Health and Marine Resources, and they are aware that these are the sites that have been suggested for further investigation.

Representative BATES. This is a definite suggestion. That is what it says in the statement of General Luedecke. Two other sites that were not identified in the NAS–NRC report but suggested by the NAS-NRC Committee, local representatives of the Fish and Wildlife Service and representatives of the Massachusetts Departments of Health and Marine Resources.

Mr. LIEBERMAN. They were all consulted in the selection of these sites for location.

Representatives BATES. Then they did not suggest them, is that correct?

Mr. LIEBERMAN. I think this would be correct. I did not participate in the meeting and could not answer it directly.

Representative BATES. This is General Luedecke's statement. What does he mean?

General LUEDECKE. I believe it is correct, but I would like to provide information for the record after I check.

(The information referred to follows:)

At the Woods Hole meeting of June 18–19, 1959, of the National Academy of Sciences working group and other scientists representing the U.S. Fish and Wildlife Service, U.S. Public Health Service, University of Connecticut and the Woods Hole Oceanographic Institution, the two areas off Rhode Island recommended in NAS Publication 655 were removed from further consideration. At this meeting, representatives of the U.S. Fish and Wildlife Service specifically suggested the area east of South Wellfleet. The other area south of Martha's Vineyard was more of a consensus selection of the total assemblage. Later, an AEC representative visited the representatives of the Massachusetts Departments of Public Health and Natural Resources in Boston and they agreed with and/or concurred in the selection of all four sites for further studies.

Representative BATES. This area is 12 miles out of Martha's Vineyard, and another is 10 miles east of South Wellfleet. They are just offshore. I wonder if you had received the concurrence of your local people as your text indicates.

General LUEDECKE. Not in any formal manner, no.

Representative BATES. You merely discussed it with them.

General LUEDECKE. That is my understanding. They were in agreement that they were suitable areas for investigation.

Representative BATES. What was that?

General LUEDECKE. It is my understanding that they were in agreement that these were suitable areas for investigation, that is all.

Representative BATES. Thank you.

Representative HOLIFIELD. You may proceed, General.

General LUEDECKE. Nature and extent of ocean waste disposal to date:

In evaluating or establishing any waste disposal system three basic considerations are involved as follows:

1. The specific nature and quantity of the radioactive waste to be disposed of.

2. The characteristics of the receiving environment.

3. Basic radiation protection standards established by the Commission in its regulation, Standards for Protection Against Radiation (10 CFR 20).

The radiation protection standards established by the Commission are used on the best available biological and medical information and on recommendations of the National Committee on Radiation Protection and the International Committee on Radiation Protection. The recommendations of the two committee have been agreed to by various national and international organizations.

Radioactive wastes are considered by many people as an uncategorized entity. The word "radioactive" has been so strongly impressed that it has become an all-inclusive term, to the point where important characteristics of waste such as quantity and concentration of radioactive material and detailed chemical and physical nature are often overlooked. However, these characteristics are the keys to meaningful understanding and discussion of radioactive waste operations.

The radioactive material involved in AEC sea disposal operations off both the Atlantic and Pacific coasts is of a relatively low of intermediate level compared with highly radioactive wastes produced at AEC production sites such as Hanford or the National Reactor Testing Station. The wastes disposed at sea contain quantities of radioactivity normally associated with research and development activities rather than production or chemical reprocessing.

For example, in terms of radioactivity concentration, the relatively small quantity of liquid wastes finally disposed at sea (after solidification) are less than a curie and generally in the thousandth or millionth of a curie per gallon range, whereas the liquid high level waste resulting from chemical processing operations at Idaho might have concentrations in the hundreds or thousands of curies per gallon. Thus we have a factor of difference in concentration of the order of tens or hundreds of millions. Also the total number of gallons (i.e., total quantity of radioactivity) evolving from the two situations is vastly different. As an example, in 1957 the AEC disposed off both coasts of the United States at designated locations 686 55-gallon

drums of solidified laboratory waste liquids (this volume includes concrete and other solidifying agents). On the other hand there are about 65 million gallons of high level wastes in storage at Hanford, Savannah River, and Idaho. We do not propose to dispose of these at sea, even though some oceanographers may indicate that a "dilute and disperse" waste disposal approach may be theoretically possible.

Representative HOLIFIELD. Again I think we ought to emphasize that we are talking about low level waste disposal in the ocean, and that the high level wastes generated in reactors are being disposed of in steel tanks and in concrete canyons on land in Idaho and at Hanford and Oak Ridge.

General LUEDECKE. That is correct, sir.

Representative HOLIFIELD. Some lower high-level wastes, I believe, at the Redstone Arsenal are also being disposed of on land.

General LUEDECKE. I am not sure of that.

(The information referred to follows:)

The Department of the Army's Redstone Arsenal, Huntsville, Ala., holds several AEC byproduct material licenses which cover a possession limit of approximately 126 curies of a variety of radioisotopes for use in connection with the missile program. Waste disposal at this installation is carried out in accordance with the Commission's part 20 regulation. Small amounts of krypton 85 gas are discharged into the air. Also, trace amounts of activity are discharged into the sanitary sewer system. Other waste material is being stored. No waste material is being buried in soil.

Representative HOLIFIELD. Is that low level waste?

General LUEDECKE. I am not aware of that.

Representative HOLIFIELD. That is the General Electric plant close to the Redstone Arsenal.

Mr. LIEBERMAN. At Savannah River.

Representative HOLIFIELD. Yes.

Mr. LIEBERMAN. At Savannah River the high level wastes are stored in tanks on land.

Representative HOLIFIELD. They are not taken out to sea.

Mr. LIEBERMAN. That is correct.

Representative HOLIFIELD. Mr. Toll.

Mr. TOLL. You do dispose of some level wastes similar to these we are talking about here by burial on land; do you not?

Mr. LIEBERMAN. That is correct.

Mr. TOLL. What are the comparative economics of such disposal on land as compared to disposal at sea?

Mr. LIEBERMAN. This, I think, depends on the location of the installation. Generally speaking, because of the extra packaging required and transshipment required for sea disposal, this would be a more expensive way to handle these wastes. On the other hand, at places like the Brookhaven National Laboratory or the Lawrence Radiation Laboratory, because of their proximity to the oceans, it is probably more convenient and more economic for them to dispose of this kind of material at sea.

General LUEDECKE. There are other questions concerning the land burial that go beyond economics. In order to bury long-lived isotopes, even of low level, on land, it would be necessary that the Commission in some manner assure ownership or control of that land for very extended periods. We are unable to see how this can be accomplished when ownership is vested in an individual or even a company at this

time. This would bring us to designating Government lands for disposal. This problem is being studied. But I think again probably the economics would not be the controlling factor.

Representative HOLIFIELD. In any event, at this time, any licensee must dispose of this material in designated places, whether it be on land or on the ocean.

General LUEDECKE. That is correct, sir.

Mr. PRICE. So far we have refused all applications by private companies for a license to run a land disposal operation, because we did not see how we could get assurance of what you might call perpetual or at least indefinite maintenance.

Representative HOLIFIELD. Congressman Price.

Representative PRICE. Of course, we are talking here about disposition of wastes of low level of materials involving radioactivity. Is there any hazard involved in the disposition of wastes coming from the operations in the handling of lethal metal such as beryllium, and so forth?

Mr. LIEBERMAN. Beryllium is, of course, a toxic material, and would have to be handled as such. As far as I know——

Representative PRICE. Not toxic, but lethal.

Mr. LIEBERMAN. Its toxicity is chemical rather than radioactive. This is not involved in the criteria or the description of our radioactivity disposal.

Representative PRICE. Is there any control over the disposition of such wastes?

General LUEDECKE. There is control, Mr. Price.

Representative PRICE. Who has that control?

General LUEDECKE. I can't answer that question directly. It is not in the Commission's licensing area.

Representative PRICE. Is there any particular hazard involved in its disposal?

General LUEDECKE. I am sure there would be, sir. I am not prepared to answer that question.

Representative PRICE. The reason I ask the question is because I understand that the Great Lakes in one or two areas has been used for the disposition of this type of waste.

General LUEDECKE. I am not aware of that, sir.

Representative PRICE. Would you rather check on that and see who has the control over it, and how they exercise it and what precautions are necessary? I don't even know if there are any necessary or not. Since we are talking about the overall question of disposal that might affect life, it might be something that you could give us a report on.

General LUEDECKE. I would prefer to do that, if I may.

Representative HOLIFIELD. You may proceed, General.

General LUEDECKE. The wastes considered for sea disposal originate in various AEC research and development operations and in research laboratories of hospitals, universities, industrial firms, and other places where radioactive isotopes are used for various purposes. The radioactive waste itself usually is in the form of contamination on equipment such as test tubes, bottles, rubber gloves, blotting paper, and rubber tubing. This trash is packaged within concrete in 55-gallon drums or in preformed, reinforced concrete boxes before disposal.

Although experience in other countries has demonstrated the safety and practicality of disposal of bulk radioactive liquids at sea, all radioactive wastes disposed of by the AEC and licensees off both the Pacific and Atlantic coasts of the United States have been in the solid or packaged form, with two minor exceptions. These exceptions involve millicurie quantities. Most of the waste has been contained in 18-gage, 55-gallon drums with concrete liners and concrete tops and bottoms for weighting and shielding purposes.

Since 1951 the AEC has disposed of a quantity of radioactivity estimated at slightly less than 8,000 curies (at the time of disposal) into the Atlantic Ocean. This material has been contained in approximately 23,000 55-gallon drums. Two major disposal areas have been used. One is located approximately 150 miles southeast of Sandy Hook (38°30′ N., 72°06′ W.). Since early 1957 most of the disposals have been in an area approximately 230 miles southeast of Sandy Hook 37°50′ N., 70°35′ W). In addition, the reactor structure of the seawolf prototype at West Milton was disposed into the former area in early 1959.

Both of these areas are off the Continental Shelf, and in a thousand fathoms of water or deeper. Although the number of curies associated with this equipment was estimated at 33,000, it was all in the form of induced activity in the type 347 stainless steel and would be released to the sea only through corrosion of this material. Based on known corrosion rates, it is estimated that this release rate would not be more than two or three curies per year.

Senator ANDERSON. Would you explain there just how that is? Is there a possibility when you have corrosion and, therefore, open up the whole container that all of it does not escape?

General LUEDECKE. The radioactivity associated with the *Seawolf* is that activity induced into the metal by the former presence of the reactor core. This disposal does not involve the reactor core. Since it is contained in the metal, it would only get into the sea by corrosion.

Senator PASTORE. In other words, the dispersal of the curie element is dependent upon the degree of corrosion?

General LUEDECKE. Yes, sir. Does that answer your question, sir?

Senator ANDERSON. Yes. I thought you might be referring to something besides the *Seawolf*. You are referring only to the *Seawolf*.

General LUEDECKE. I was referring only to the *Seawolf* in that statement.

In the Pacific Ocean sea disposal operations began in 1946. Since then approximately 14,000 curies (at the time of disposal) contained in about 21,000 drums and 329 concrete boxes have been disposed of in an area approximately 48 miles west of the Golden Gate (approximately 37°39′ N., 123°26′ W.).

Representative HOLIFIELD. That is also off the Continental Shelf.

General LUEDECKE. Yes, sir. Also since 1953 about 60 curies contained in about 2,950 55-gallon drums have been disposed in an area approximately 53 miles west of Point Vincente, Calif. (approximately 33°39′ N., 119°28′ W.). The distances noted in this paragraph are in nautical miles (6,000 feet rather than statute miles of 5,280

feet.) Both of these areas are in depths of water of a thousand fathoms or greater. These operations were carried out by the U.S. Navy at the Commission's request. The radioactivity content ranges from about one half a millicurie to 15 curies per drum for the solid wastes—with most around one-half curie or less, and one-half millicurie to 1.5 curies per drum for the solidified liquid wastes at the time of disposal. The AEC has not disposed of any radioactive waste materials into the Gulf of Mexico.

At present there are seven commercial firms licensed by the Atomic Energy Commission to collect, package, store and dispose at sea in at least 1,000 fathoms solid or packaged low-level radioactive waste generated by AEC licensees and contractors using radioisotopes in medicine, industry, agriculture, research and training. Four such firms are licensed to dispose of waste in the Pacific Ocean and their records show that approximately one-half curie of byproduct material and 15 pounds of source material have been disposed of in the Pacific Ocean to date. Four firms are licensed to dispose in the Atlantic Ocean and their records indicate a total disposal of approximately 2,500 curies of byproduct and source material to date.

Representative BATES. Where are these four located?

General LUEDECKE. The four firms are on the Atlantic Ocean.

Mr. PRICE. They are listed in this separate paper that General Luedecke was going to offer for the record. One of them is Crossroads Marine Disposal Corp. in Boston that we previously talked about. Another one is Nuclear Engineering Co., which has recently obtained a license and plans to dispose in both the Pacific Ocean and the Atlantic Ocean, the New England Tank Cleaning Co., of Cambridge, which is a recent licensee. I believe the fourth one is Walker Trucking Co., in Portland, Conn. That particular licensee is not yet in business because he is having trouble with the city of Portland zoning regulations.

Senator ANDERSON. How many are not in business? How many actually have done anything? Start off there with the four again.

Mr. PRICE. The present licensees on the Atlantic are Nuclear Engineering Co.

Senator ANDERSON. Has it been in operation yet?

Mr. PRICE. Kearny, N.J. They are in operation. They got their license in October 1958. They have not yet made a disposal. Our latest information is that they have on hand 34 curies.

Senator ANDERSON. They have not made a disposal?

Mr. PRICE. That is right. Remember, this is deep water, and they wait until they get a sufficient quantity to justify a trip out to deep water.

Senator ANDERSON. My interest arises in the fact that you said that four firms are licensed to dispose in the Atlantic Ocean, and their records indicate a total disposal of so much. Then you read them off and said they have not disposed of anything. Somewhere it has to balance

Mr. PRICE. I am sorry. I am trying to find out if any except one has made a disposal, and it looks like only one has made a disposal to date.

Senator ANDERSON. Which one is that?

Mr. PRICE. That is Crossroads Marine.

Senator ANDERSON. Where is the disposing of this?

Mr. PRICE. Off Massachusetts, in Massachusetts Bay.

Senator ANDERSON. And they have disposed of 2,500 curies by themselves?

Mr. PRICE. I think that is right; yes, sir.

Representative HOLIFIELD. It would be helpful at this point to say that you allow these licensed contractors to accumulate up to a certain level. Please give the committee that level of curies in their storage yards before they have to transfer it from their storage yards out to the disposal area.

Mr. PRICE. They usually ask for a possession limit based on what they think their business is. We don't particularly care how much they accumulate so long as it is packaged in accordance with the shipping requirements of the Interstate Commerce Commission which are based on protecting photographic film that might be in the same shipment. Then they have to encase it. They have to fill these drums with concrete to make enough density to sink in the thousand fathoms of water.

(The information requested above follows:)

The amount of radioactivity a waste disposal licensee may accumulate or store at his facility is controlled by the possession limit specified on the AEC license. The possession limit is the amount of radioactivity the licensee may have in his possession at any one time and is based on his anticipated needs and his capabilities and facilities for storing that amount of waste. In actual practice an applicant for a sea disposal license indicates in his application the maximum amount of radioactivity he expects to have in his possession at any one time. This is based on the volume of business he expects to receive and the size of his facilities for storing the waste. The Commission specifies in such licenses the possession limit requested by the applicant if it appears the applicant has the necessary capabilities and facilities to handle and store safely the amount of waste requested. The possession limits vary from 10 curies to 1,000 curies of byproduct material, 15 pounds to 25,000 pounds of source material, and 4 grams to 100 grams of special nuclear material. Waste disposal licenses also limit the maximum amount of radioactivity in each container the licensee receives, possesses or transfers to 2.7 curies, which is the same limit specified in the Interstate Commerce Commission regulations for the transportation of radioactive materials.

Sea disposal licensees are required to dispose of radioactive waste off the Continental Shelf where the ocean depths are at least 1,000 fathoms. These locations are about 100–200 miles from shore on the Atlantic and gulf coasts and less than 100 miles from shore on the Pacific coast. Thus, seagoing equipment is necessary for transporting the waste to the disposal site. Consequently, it is necessary for these licensees to store waste received until a sufficient quantity of waste has been accumulated to warrant a trip to sea.

Representative HOLIFIELD. In the case of contaminated pipes from reactors from your own facilities, and that sort of thing, do they also have to take those pipes and cover them with cement and cut them up and imbed them?

Mr. PRICE. Sir, I don't know how the AEC material is disposed of. It is usually in drums.

Mr. LIEBERMAN. Yes.

Representative HOLIFIELD. I am talking about contaminated pipes. You have had that. I know of one instance in which a contractor has some of this contaminated pipe on hand. The thing I am asking is, Upon receipt of that material, do they have to embalm it in cement?

Mr. LIEBERMAN. The type of material you are referring to has generally been buried on land. I don't know that that type of equipment—that is, pipe—has been disposed of at sea by AEC operations.

In any case, contaminated equipment to be disposed of at sea is put in a package; generally speaking, this package is a 55-gallon drum with the concrete around it necessary to make it sink.

Representative HOLIFIELD. Then the answer is that the pipe has to be cut into lengths to put in drums and encase it in concrete so it does not throw off any radiation. In one instance the contractor told me he was allowed to store up to 100 curies in his storage yard. Then he had to dispose of it. He had to take it and permanently dispose of it. Does that coincide with your information?

Mr. LIEBERMAN. Yes. This sounds quite correct.

Representative BATES. I was asking about these four sites. So you have the nuclear company in New Jersey and you have Crossroads in Boston—and that is the one that has put it all out to date?

Mr. PRICE. That is right. The others are accumulating it. They have some on hand.

Representative BATES. Two or three months ago I was looking at the licenses given by the AEC to various universities, including disposal. About 2 months ago there was one given to a concern in Boston. We have one here last September—the New England Tank. This is September 1958. Where is the one that I read of about 2 or 3 months ago? Is this record up to date here?

Mr. PRICE. This is up to date, sir. I don't know which you might have read about. The one you probably read about was the Walker Trucking Co. who got a license for Portland, Conn. He is having trouble with the city authorities that have zoned his place of business, I believe, so that he cannot use it. He applied for an amendment to his license for another location. That may be the one you read about.

Representative BATES. Is that Boston? I am talking about—2 or 3 months ago there was a new site out of Boston by some trucking company, who was given a new license. It could not be this New England Tank, that was last September.

Mr. PRICE. That was last October. That is right.

General LUEDECKE. We are not aware of one. May we look that one up and supply you with the answer?

Representative BATES. I will look it up. I have it back in the office somewhere.

Mr. PRICE. The only companies that have licenses are the ones that are listed here as of now. There are pending applications. Let me read them off and see where they stand. These are the pending applications: Ocean Transport Co., Richmond, Calif.; California Salvage Co., San Pedro, Calif.; Nuclear Chem Corp., Bellarosa, N.Y.; Military Sea Transportation Service, Washington, D.C.; Industrial Waste Disposal Corp., Houston, Tex. I still don't see another pending one.

Representative BATES. I will find it somewhere, if I can, among the accumulation of papers. I read it about 2 or 3 months ago, because it was the first instance where I had seen one of these licenses. It was out of Boston for waste disposal. You might have amended the Crossroads one.

Mr. PRICE. We have amended Crossroads.

Representative BATES. Was that 2 or 3 months ago?

Mr. PRICE. That was more recently than that, although there was probably a notice published of the pendency of it. I will have to check the record.

Representative BATES. It might have been an amendment. I could not be sure of that. I know a new license was granted. It might have been in amended form. I will find that out.

Representative HOLIFIELD. You may proceed, General Luedecke.

General LUEDECKE. In addition, eight organizations are licensed by the Commission to dispose of the waste generated in their own laboratories. Six of these organizations have disposed in the Atlantic Ocean a total quantity of approximately 31 curies of activity. Two licensees in this category have disposed of approximately 101 curies of activity in the Pacific Ocean.

In addition to the above-described licensed waste disposal operations, a few licensed users of byproduct materials disposed of waste at sea prior to 1958 but have discontinued the practice. In this group, 6 organizations disposed of a total of approximately 4 curies into the Atlantic, 2 organizations a total of less than 1 curie into the Pacific, and 2 organizations a total of approximately 10 curies into the Gulf of Mexico.

There are at present five license applications pending for disposal of radioactive waste. Two of these concerns propose to dispose of packaged waste in the Pacific Ocean, one in the Atlantic Ocean, and one in the Pacific or the Atlantic Ocean. One application to dispose of packaged radioactive waste in the Gulf of Mexico in 1,000 fathoms of water is pending review by the Atomic Energy Commission.

We have prepared a detailed summary of sea disposal licenses currently in effect. This summary includes an identification of the sites authorized for each of the licensees to dispose of radioactive wastes. With the permission of the committee, I should like to furnish copies of the summary for the record.

We should also like to furnish for the record a copy of a typical sea disposal license showing the various conditions and limitations incorporated in the license to assure proper handling and disposal of the radioactive waste. This license is one issued in May 1959 to the Public Health Service, National Institutes of Health.

At a later point in our prepared statement, we shall describe the licensing procedures observed by the Commission in connection with sea disposal licenses.

The major objectives of the criteria for our sea disposal operations are to assure adequate packaging for safe handling between the site of the waste originator and the final disposal and to assure the sinking of the packages in the sea, generally in areas 1,000 fathoms or deeper.

For example, the package must be able to withstand handling operations during loading and unloading procedures without exposing the contents. A minimum of 10 pounds per gallon of displacement volume is required to assure sinking. Packages also must be properly labeled. If materials are shipped by common carrier, conformance with Interstate Commerce Commission and Coast Guard regulations is required.

It is not required that the packages be so constructed as to maintain their complete structural integrity at a depth of 1,000 fathoms of water, although the package and its contents must be fabricated and prepared to prevent the material from floating to the surface.

With the quantities and characteristics of the radioactive materials involved and with the diffusion and transport capabilities of the ocean

environment, it is not necessary to assure continued containment of the radioactivity at 1,000 fathoms.

In fact, allowing the natural processes of diffusion and dilution to act assists in the prevention of buildup of significant sources of radioactivity. A secondary factor is the difficulty and expense involved in constructing true pressure vessels to withstand the tremendous pressures at great ocean depths.

Protection of the public health and safety, as stated previously, is the overriding consideration in the management and administration of all atomic energy operations including the disposal of radioactive wastes at sea. It is our belief that these sea disposal operations are being carried out in a manner that is safe and adequate. This belief is based upon:

(1) Views of experts in the marine sciences and other pertinent fields;

(2) The actual operating experience of the British in disposing of greater quantities of radioactive material in a more mobile (liquid) state; and

(3) The preliminary, but direct information obtained in both the Atlantic and Pacific Ocean disposal areas in actual field studies.

To further delineate the basis for our belief in the safety of the AEC's sea disposal operations, we would cite the recent report of the NAS-NRC (Publication 655 previously referred to).

The group of marine scientists that prepared this report, indicated after careful and conservative consideration of the various factors involved, that it was feasible to dispose safely solid, packaged wastes of the type previously described at several in-shore, shallower water locations along the Atlantic and gulf coasts.

Mention must be made of the British experience in disposing of bulk liquid wastes into the Irish Sea. As a result of detailed investigation by British atomic energy facilities and public health authorities, the British Government concluded that it would be safe to discharge radioactive materials directly through a 3-mile pipeline into the Irish Sea at the rate of 1,000 curies per month.

As a result of actual monitoring studies during an extended period of discharge at that rate, it was determined that the discharge rate could be increased safely to 10,000 curies per month. Reports of this work have been published.

In October 1957, at the request of the Commission, a survey of the Atlantic Ocean disposal area located approximately 150 miles southeast of Sandy Hook was conducted by the Chesapeake Bay Institute in cooperation with the U.S. Coast Guard and Geodetic Survey.

The survey consisted of taking a series of samples of ocean bottom in and near the disposal site. Radiological analyses of these samples indicated no radioactivity detectable above background levels.

A similar survey by the Scripps Institution of Oceanography of both the Pacific Ocean disposal areas previously noted indicated comparable results. Although the surveys were of a preliminary nature, the direct data obtained do not indicate any buildup of radioactivity of public health significance in the disposal areas.

Representative HOLIFIELD. You do that by going down and getting samples of the sediment on the bottom and testing that?

General LUEDECKE. An analysis of that, yes, sir, and its comparison with the background level of the water in that area.

GENERAL NATURE OF AEC RESEARCH AND DEVELOPMENT PROGRAMS PERTAINING TO SEA DISPOSAL

The AEC supports an extensive research and development program in oceanography and the marine sciences that relates directly to the disposal of radioactive materials in the oceans. It was one of the three Federal agencies that originally requested the NAS to establish a Committee on Oceanography and has contributed to the support of that group since its establishment. It has also actively participated in the interagency Coordinating Committee on Oceanography since the inception of that group.

In the AEC Division of Reactor Development in fiscal year 1960, expenditures in the amount of approximately $250,000 are planned in connection with research and development projects pertaining directly to the disposal of radioactive materials in the marine environment.

These projects include investigation of estuarine circulation and the fate of radioactive materials which may be introduced into estuarial waters. Specific field data are being obtained in New York Harbor and model studies of other estuaries have been carried out at the Vicksburg Waterways Experiment Station of the Corps of Engineers.

Organizations involved or cooperating in this work are the Maritime Administration, U.S. Coast and Geodetic Survey, and the Chesapeake Bay Institute of the Johns Hopkins University.

In the AEC Division of Biology and Medicine, a number of projects in the field of marine biology and physical oceanography are being supported. Although many of these projects were initiated in connection with weapons tests, the information obtained is also applicable in many respects to sea-disposal activities.

A detailed summary of this program was recently presented to the Subcommittee on Oceanography of the House Committee on Merchant Marine and Fisheries. A copy of that report has previously been furnished to the Joint Committee on Atomic Energy.

Representative HOLIFIELD. At this time, the Chair will recognize the presence in the committee room of Congressman Jack Brooks of Texas.

Congressman, would you care to address the committee?

STATEMENT OF HON. JACK B. BROOKS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Representative BROOKS. I would, Mr. Chairman. I appreciate the opportunity to testify. I would like to say, concisely, that I am very much in favor of H.R. 8187 and have serious misgivings about the proposal to dump atomic radioactive waste into the Gulf of Mexico. I would like at this time to follow the House pattern of revising and extending my remarks at this point in the record.

Representative HOLIFIELD. The Chair will be happy to receive your statement and compliment you on your appearance.

Representative BROOKS. Thank you very much, Mr. Chairman.

(Congressman Brooks' statement referred to follows:)

Mr. Chairman, may I take this opportunity to thank you and the members of this distinguished committee for your expeditious consideration of this legislation and for the opportunity to submit my views to you concerning the very serious problem of disposal of radioactive waste in our coastal waters.

Our colleague, Congressman Clark Thompson, who is author of H.R. 8187, represents the district immediately adjacent to mine back home. The fish and shrimp move back and forth off our beaches pretty freely and our constituents who are interested in having a few "specs" or a little shrimp gumbo for supper move back and forth along the beaches, just as freely. In short, our good friend Clark Thompson and I stand shoulder to shoulder in our deep concern over the disposal of radioactive waste close to our beaches.

Of direct concern to my people in southeast Texas is the proposal submitted to the Atomic Energy Commission by the National Academy of Sciences to dump radioactive waste material 19 miles off Sabina Pass, in Jefferson County, in water that is only 42 feet deep.

Of additional concern to us is the implication generated by the Atomic Energy Commission that this waste is liable to be dumped within a few miles off my district and some 27 other locations whether the people of this country like it or not.

I was present in Congressman Thompson's office several weeks ago when three representatives of the Atomic Energy Commission were questioned for 3 hours about a pending license application for dumping at another location in the Gulf of Mexico. Since that meeting I have been in close touch with Congressman Thompson and other members of the House who are as intensely interested in this problem as I am. To date, I know of no indication from the Atomic Energy Commission to any of us that the AEC is slowing down in the slightest in their apparent plans to dump this waste in coastal waters along the Atlantic seaboard or the gulf coast.

At that meeting in Congressman Thompson's office, I asked the AEC representative for a simple, concise statement that the dumping of radioactive waste in the gulf would not prove harmful to the marine life, marine environment, or our people. I have not yet heard one word from the AEC to this effect. Instead we hear reports that more studies will be made before the waste material will be dumped off our coast.

I am pleased to hear that more studies will be made. Every responsible Federal agency and scientist I've been able to contact have each insisted that more studies and more accurate information is needed before any final determination should be made.

But the basic issue apparently has not yet been recognized by the Atomic Energy Commission and that is: What do the people of the United States have to do to prohibit this proposed dumping of radioactive material in close to our beaches, in shallow water, until we can know positively that it is a safe, feasible, and workable procedure?

Surely the people of the United States are entitled to know all the facts available concerning the dangers in this program. If the Atomic Energy Commission does not know what the short-range or long-range dangers might be, why can't they simply say they don't know. If the AEC wants to license companies to dump radioactive waste close to our beaches just to save money on dumping contracts, why don't they simply say this. If the AEC believes that every ship that leaves port to dump radioactive waste should have a representative of the ATC aboard to insure dumping in designated areas, why don't they say the inspection system will be costly?

Mr. Chairman, there are so many questions that are unanswered my people and I have little choice except to vigorously oppose these dumping proposals apparently sponsored by the Atomic Energy Commission.

From my impressions of the Atomic Energy Commission's attitude in the matter, the only way we can be sure that the AEC will not license dumping of radioactive waste close to our beaches is to specifically prohibit such dumping by general legislation. Congressman Thompson's bill, H.R. 8187 would, I believe, accomplish that purpose and I therefore urge the committee to give this legislation your favorable consideration.

Thank you, Mr. Chairman and members of the committee, for taking time to consider my views on this vitally important problem.

Representative HOLIFIELD. Congressman Hastings Keith of Massachusetts is also present.

STATEMENT OF HON. HASTINGS KEITH, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MASSACHUSETTS

Representative KEITH. Mr. Chairman, I, too, have two proposed sites within my district, one of them off of no-man's land and the other off Wellfleet. I know that the committee will safeguard the interests of my district as they are those of the others.

I appreciate your giving me an opportunity to speak to your committee.

Representative HOLIFIELD. Thank you very much, Congressmen. We will certainly take into consideration these locations near your district.:

Representative KEITH. Thank you, sir.

Representative HOLIFIELD. You may proceed, General.

General LUEDECKE. Procedures observed in licensing disposal of radioactive waste in the sea:

An applicant for a license to dispose of radioactive waste in the ocean must submit a detailed description of his proposed activities including the type and quantities of radioactive material including the type and quantities of radioactive material to be possessed; the waste container and packaging specifications; the site for packaging and storage of the waste; transportation procedures; instrumentation for measurement of radiation levels and contamination; radiation safety and emergency procedures to be followed in collecting, packaging, storage, transportation, and disposing of the waste material; the disposal location including the depth of water; and the type of records to be maintained.

Senator PASTORE. What are the considerations that led to the decision of adopting the policy of disposal which is now being practiced by the Commission in water that is at least 1,000 fathoms deep?

General LUEDECKE. This goes back before my time, sir. I would like to ask Mr. Price to answer your question.

Mr. PRICE. I think the 1,000 fathoms criterion, Senator Pastore, came from recommendations of the National Committee on Radiation Protection.

Senator PASTORE. Was that as the result of a survey?

Mr. PRICE. I am afraid I can't speak authoritatively on the extent of their investigations but the National Committee on Radiation Protection published in 1954 or 1955 a handbook containing suggested criteria for disposal of low-level radioactive wastes at sea.

Dr. Lieberman, I believe, was associated with that work and could explain what was back of the recommendations.

Senator PASTORE. Dr. Lieberman, what have you got to say?

Mr. LIEBERMAN. I was not associated with that work. I am familiar with the publication of that report. It is handbook 58. As I recall a group of oceonographers and other marine scientists were involved in the preparation of that report. That handbook was used as the basis for establishing the criteria that General Luedecke has just described.

Senator PASTORE. Is it fair for me to assume that this is quite a retreat from the finding of 1954, which specified the disposal of this atomic waste in a depth of 1,000 fathoms? Here we are talking about locations only 23, 24, and in some instances only 50 fathoms deep. Is that not quite a retreat?

Mr. LIEBERMAN. I would like to say that it represents an increase in oceonographic knowledge.

Senator PASTORE. That is just the point. Where was this knowledge gathered? I understand that you said that certain tests have to be made and that the survey has not been completed. Knowledge predicated upon what? Has this British experience been controlling?

Mr. LIEBERMAN. No, sir, I would not say the British experience has been controlling at all. There have been oceonographic studies carried on by various oceanographic institutions since 1954, resulting in additional information on the concentration of radioactive materials by marine life, additional information on diffusion in transport of materials that might be introduced into ocean currents.

Work has been going on in various places in these areas since 1954.

Senator PASTORE. How many reports have there been since 1954?

Mr. LIEBERMAN. I can't answer that question directly. Perhaps the representative of the National Academy of Sciences Committee on Oceanography could reply to that question more directly.

Senator PASTORE. If there had been other reports which would induce a deviation from the original policy or the original thinking that 1,000 fathoms is required, why has the Commission then persisted in maintaining its adherence to the policy of dumping at 1,000 fathoms even up to this moment?

Mr. LIEBERMAN. This 1,000-fathom criterion was something that had been recommended by a group whose general competence and authority was recognized, the National Committee on Radiation Protection. There simply had not, up to the time of this NAS-NRC report, been a new request for a review or assessment of this subject by an authoritative group. There was not in existence a National Committee on Oceanography until sometime in 1957. There was not in existence an authoritative group that could take a look at this in the light of additional information.

Senator PASTORE. General Luedecke, has this report by these eight scientists under the auspices of the National Science Foundation on Oceanography been considered by the Commission?

General LUEDECKE. It has not, sir.

Senator PASTORE. It has not?

General LUEDECKE. It has been considered by the staff, with the desire to go ahead with the investigation of some of the sites in terms of gathering information.

Senator PASTORE. Has there been concurrence with regard to these recommendations by the staff?

General LUEDECKE. The concurrence in the recommendations of the report——

Senator PASTORE. That you can retreat from this position of 1,000 fathoms.

General LUEDECKE. I do not feel that this is involved in this report. It is a report that they have made at our request and is now before the Commission for their information and consideration. Our concurrence in it is not involved.

Senator PASTORE. You gentlemen are experts on it and I am not. I am asking the question, what in this report justifies any attitude on the part of the Commission or its staff as against the policy now

invoked or practiced of 1,000 fathoms? Where is the scientific or technological data or reports that justify this new position?

Can anyone point that out to me? In other words, what has taken place since 1954 that requires the change of this thinking on this subject?

General LUEDECKE. The committee who looked at it has determined to its satisfaction that disposal in these in-shore areas will be safe with some investigation. We feel that we should go ahead with these investigations in accordance with the recommendations of the committee.

Senator PASTORE. Let us take that 10- by 10-mile area, 45 miles off the Sackonnet coast of Rhode Island. As I understand, and correct me if I am wrong, all that this group did was to have a deep sea diver determine that once the cement casing was dropped it did not become dismembered. Am I correct in that?

Have there been any surveys made at all as to the hazards involved in that location?

Mr. LIEBERMAN. Sir, there have not been surveys. The group that prepared this report, I am sure, did take into account the available oceanographic information, the biological information, and other pertinent data that allowed them to reach the conclusions that they did.

I am not speaking in direct defense of their report but just to indicate the types of information that were involved in their deliberations and in their conclusions and recommendations. I feel sure that they will speak to this point when they testify.

Senator PASTORE. I would withhold my line of questioning on this point until they testify here. I have introduced it merely to provoke their thinking on it so as not to catch them by surprise. What is puzzling to me at the moment is this: Irrespective of all these reports and surveys that were made since 1954, the Commission has clung to the policy of disposing at 1,000 fathoms.

General LUEDECKE. That is correct.

Senator PASTORE. Suddenly we hear it is safe to do it at 22 and 23, which is quite a variance.

I am asking the question, where we have been up to the time this report was published and what substance, scientifically, is there for the selection of these particular sites chiefly in the Rhode Island and Massachusetts area without referring it back or associating it with any particular report?

General LUEDECKE. I think the National Academy of Sciences representative will reply to that question. They are the ones who came up with the report and recommended that these might be suitable, subject to certain further investigations.

Senator PASTORE. Was this group told that you would like to have two or three sites around Rhode Island and Massachusetts because of the concentration of industrial use of atomic isotopes for commercial purposes and medical purposes in that part of the country?

General LUEDECKE. Not in those words, to my knowledge. I will have to ask Dr. Lieberman to answer that question.

Mr. LIEBERMAN. Along the Atlantic and gulf coasts is the way the situation was put to the National Academy of Sciences group. If you are referring to these four sites that we propose for field study, the reason we think that these field investigations should be initiated

there is because of the concentration of users of radioactive materials in the New England area.

Senator PASTORE. But the word New England was mentioned to the committee?

Mr. LIEBERMAN. Insofar as initiation of the field investigations that they recommended in the report, yes, sir. But insofar as the report itself is concerned, it was put to them on the basis of the Atlantic and gulf coasts.

Senator PASTORE. Were you connected with the survey?

Mr. LIEBERMAN. No, sir; I was not.

Senator PASTORE. I will defer this line of questioning until such time as the writers of the report testify. I am very much interested in what led to this, what I consider, quite a drastic change in such a sudden fashion. We have been told here today about a disposal company in Massachusetts that had injected in the waters in an area not too far from the coast waste of about 2,400 curies in a period of several years, since 1951, to the present time. Then when a new licensee applied they were all told to push their activity out to 1,000 fathoms.

How long ago was that decision made?

Mr. PRICE. I think that there were no applications for commercial waste disposal, other than this old one that had been in force since 1952, until either late 1957 or early 1958.

Senator PASTORE. In 1958 we decided in the Massachusetts area not to go out that short distance but to go out to 1,000 fathoms. Certainly, you were receiving these reports in oceanography between 1954 and the early part of 1958.

Here we are suddenly told, with a sort of a feeling on the part of Mr. Luedecke, who is testifying now, while he has not said that a decision has not been made, he does not look too unfriendly or unfavorably upon this recommendation.

After all, you are continuing your studies in the Massachusetts and Rhode Island area. Here we are talking about 45 miles from the shore of Sackonnet in the congested part of New England, when heretofore, up to 1958, we have adopted a policy where we are definitely dumping this atomic waste in waters that were 1,000 fathoms deep.

Mr. PRICE. Senator Pastore, could I add that not only has it been the recent policy to adhere to this 1,000 fathoms, it is the present policy and the future policy until such time as based on this report and such further studies as scientists may make, the Commission then becomes satisfied that they can relax. But right now there is no present intention to relax this 1,000 fathoms requirement.

Senator PASTORE. I am very happy to hear you say that. Is it fair for me to say that before this policy will change there will be consultation with the State and local officials?

General LUEDECKE. There will be, sir.

Mr. PRICE. And there will be public hearings before any decision will be made.

Senator PASTORE. And the people throughout Rhode Island and the rest of New England can be assured that the present policy will be adhered to that no waste will be dumped in water less than 1,000 fathoms deep?

General LUEDECKE. Yes, sir.

Senator PASTORE. I am very glad to hear you say that.

General LUEDECKE. I intend to cover that in my statement.

Representative HOLIFIELD. The Chair wishes to commend the Commission for the care it has taken dumping wastes offshore, also on the determination that it will not change its procedure unless it is proven by good scientific evidence that it is safe to do so.

At the same time I would say that the consideration of 1,000 fathoms at sea seems to have in my mind, at least, a sufficient element of caution on it that the time might come in the future when a lesser depth could be utilized safely. I have read this report very carefully, which the National Academy of Sciences put out. In one place it says that the factor of safety introduced by 10-year containment is shown in table 3 in which the percent of initial activity remaining after 10 years and the maximum permissible concentration for drinking water are the same.

So, apparently, you are looking at this from the standpoint of having it just as safe as the allowable radiation in drinking water.

General LUEDECKE. That is right, sir.

Representative HOLIFIELD. I, personally, cannot see why all this excitement occurs just because of a few uninformed newspaper articles and editorials and a few hysterical people who feel they will be poisoned by tomorrow morning because of these activities. We are living in the atomic age. We are going to have to take care of these problems.

One easy way to take care of all these problems is to shut down all the reactors right now and quit making this material.

Mr. PRICE. Stop using isotopes, too.

Representative HOLIFIELD. We could stop using isotopes in our hospitals and stop using any X-ray machines which will create any kind of waste material which will become radioactive. This is no new problem in hospitals. They have had radioactive wastes since the advent of radium.

Mr. PRICE. Yes.

Representative HOLIFIELD. They have had to dispose of certain radioactive wastes. I feel a great deal safer having this disposal under a licensed contractor, abiding by regulations set by the best scientific knowledge we have, than to have it as it was before these standards and criteria were set up by the Atomic Energy Commission and imposed upon these people that take care of these wastes.

General LUEDECKE. Mr. Chairman, the Commission feels that we are well on the safe side in our present policy. On the other hand, a group of highly qualified, we believe scientists have said that there are probably other safe limits also available to us.

Representative HOLIFIELD. As we learn more and more about the movement of ocean currents at the bottom of oceans and the absorption by fish life of radioactive algae or plankton, we become more knowledgeable in this area.

General LUEDECKE. We are able to determine that it is safe. There are obvious advantages in being able to dispose of the waste in this manner if in fact it is safe and if in fact we can satisfy the people that this is so.

Representative HOLIFIELD. At the same time we have to recognize that the people are not as well informed on these subjects as the scientists are, and therefore, when they see items in the paper which are not complete or which are unclearly stated, they do become

alarmed. Of course, they appeal to their Congressmen and particularly to this committee.

This committee wants at all times to take the same position toward the people of the United States as we would toward our own family. We do not want to gamble with the lives of any of our population. The life of a human being is much more important than to take a chance with an unsafe cemetery, if you want to call it that, of atomic waste.

This committee has been looking at this subject for a long time. I think the general public can be reassured that we are concerned with this matter.

Representative DURHAM. Mr. Chairman, one of the things we did at Hanford is a clear demonstration of the safety precautions taken. The water that passes through the reactors was analyzed very carefully by the Commission. We have learned a lot from that operation from the beginning.

Representative HOLIFIELD. We have run millions of gallons, as you know, of water through Hanford. We had some very informative hearings in January. They are almost ready to be printed. In fact, I think they are in galley form. They are going from page to final form, Mr. Ramey tells me. Here is something that we asked out there during those hearings.

I asked Dr. Parker, head of the Safety Division, in relation to the effluent from the big atomic reactors at Hanford, the biggest concentration of plutonium producer reactors in the world, I guess, and we run this Columbia River water for cooling purposes.

Does that discharge affect the fish life of the river as far as you know?

Dr. PARKER. A substantial presentation on the work on the fish, Mr. Chairman, will appear later. Perhaps it would suit the committee's pleasure to hear Dr. Foster who is actively in charge of this project. I can say to answer the immediate question as far as we are aware there has been no damage to fish from radioactivity released in the Columbia River.

Representative HOLIFIELD. It is of such a low order that it is no danger to the cities of Pasco and Kennywick?

Dr. PARKER. That is correct. The monitoring of this affluent is an important feature. That begins in the reactor itself and is monitored immediately before release and separately analyzed.

And he goes on at some length.

Senator PASTORE. The bells have rung, and I have to go for a vote. I did not catch everything that the distinguished Cougressman from California has said, but let me say this: The junior Senator from Rhode Island, as the Commission well knows, has been one of the most enthusiasts in the purchase and in the full development of research and development in atomic energy. I have lent my support on every occasion. I realize the fact that the public has been disturbed over this current situation, but there has been reason for it. I think it is unfair to be critical of the newspapers who have reported this because this is a situation that confronted us in Rhode Island.

Almost by surprise an announcement was made, "Three atomic waste dumps off Rhode Island proposed." After all, we have lived here under a situation where we thought that in safety it was necessary to dispose of this waste in water that was at least 1,000 fathoms deep. Mr. Price today with fervor said that is going to be our continued policy unless we are convinced that we can do otherwise.

I congratulate him for that. But in Rhode Island they picked out three sites and two sites only 10 miles from the shore. Then, when the

investigation started and the furor began, we were told that they had decided to discard two of these sites.

The two that were closest to the Rhode Island coast were picked. The argument given was that it would disturb the fishing activities. Unless we are just using loose arguments and loose talk, what would that mean to the ordinary layman in Rhode Island?

Here we come along and say three sites are absolutely safe and they are picked out. Certain other investigations have to be conducted, of course. Then, overnight we abandon two of the sites that were already chosen. That leads to the apprehension on the part of the people. This idea of being critical of the newspapers, of course, is absolutely unfair because, after all, it is their obligation and responsibility to bring all these facts to the attention of the people.

But in one day we are told that you choose three sites, in all probability based upon the testimony of scientists that they would be safe enough. Then, when the furor starts, we are told that two of these sites are being abandoned because they will interfere with the fishing activities in that area.

Is that not reason for the people to be disturbed? Is that not cause for apprehension? I say this: If we are going to have the confidence of the people and if we are going to educate the public on the safety involved, I think we ought to do it a little more judiciously. If there is rebuttal to this, I will be back to answer it.

Representative DURHAM. I am sorry the Senator is leaving because I have some rebuttal.

Senator PASTORE. I will be back.

Representative DURHAM. I called attention to the Hanford operation on the basis of the safety exhibited and the caution taken by the Commission and the people who handled this problem all the way through. I do not see any use of taking more time on fish when I cannot get a few million dollars for civil defense for radiation from atomic bombs.

I wish the people would be concerned about that a little more than they are about a problem like this. If the newspapers want to play this up as one of the important things, it is their privilege, of course, and it is their obligation, I feel, to carry it to the people. I want to point out that we have handled this thing all the way through.

This is not a new problem. We are not selecting these spots. We are just talking about them. General Luedecke has told us that they are only under consideration at the present time. They will be gone into from a safety standpoint as I assume they have gone into the problems from Oak Ridge to Hanford from the begininng. That is the program we are following.

General LUEDECKE. That is right.

Representative BATES. Mr. Chairman, on that point, Mr. Price indicated that the 1,000-fathom depth has been, is, and will be, the limitation until such time as this survey has been completed and the Commission has acted on it.

Mr. PRICE. I am sorry. May I modify that?

Representative BATES. Yes.

Mr. PRICE. Let me say this: The Commission policy has not changed on the present criteria of 1,000 fathoms.

No. 2, this NAS study and the studies Dr. Lieberman says the Commission will follow up are all part of an effort to get better scientific

knowledge, but the fact that the effort to get that knowledge is going on does not at all change the present Commission policy.

If the time comes, after those four New England sites that they are going to survey, if the scientific information then indicates that they are plenty safe and ought to be used, the Commission will still be faced with the question, Do we need to use them, and should we, and we will have to have hearings on whether to do it or not.

Representative BATES. Mr. Price, to a point that is correct. But the fact of the matter is that one of these sites is being used today. Mr. Durham indicated these are prospective. One of these sites in Boston is being used and will be used until the 15th of August.

Mr. PRICE. That is right. We said that in the first part of the statement.

Representative BATES. I would like to know this: If this has been your policy, and handbook 58 published in 1954 indicated it should be at least 1,000 fathoms, how come that one of these sites has been used and is being used today?

Mr. PRICE. The answer to that is purely historical. All the guidance we could get was that there was no safety problem.

Representative BATES. You have this handbook.

Mr. PRICE. I understand.

Representative BATES. It seems to me that indicates some problem.

Mr. PRICE. This authorization started back in 1952. This operation for years was dealing with very, very small quantities. They still are: Until other people got interested in the business of going into the commercial waste disposal activity we were assured by our technical people that for the quantities of stuff that were being used, there was no problem.

There is no big quantity. Over 2,000 of those curies that that operation has dumped up there is tritium. The relationship of tritium to, for example, strontium, is a relationship of 250,000 to 1. There just has not been any danger from any information we can find.

Nevertheless, once other people started getting into this business we forced this man to go out, too, and put him on the same basis. We intend to keep him out in deep water until such time in the future as the Commission might decide that some of these in-shore locations can be used.

That is the story on Crossroads.

Representative BATES. I understand. My point is that all of these sites are not prospective. You are, in fact, today, and will for another 2 weeks, use one of these particular sites.

Mr. PRICE. That is right. We so stated.

Representative BATES. In 1954 was the time when this handbook 58 was published. How come it takes until this particular time to determine that a change should be made?

Mr. PRICE. The decision to make the change was made last fall or winter and what has been going on since is that this man has had to make arrangements to get a different base of operations because he now has to store stuff. He used to take it out in a barge. He has to have a building which he has acquired. He has to arrange for a deep-sea vessel which he did not have when he was formerly using a barge.

It has taken about the last 6 months to put him out in deep water. Prior to that time and until he got a competitor in that area, all of our scientific information was the quantity handled is no problem.

The area has been monitored, samples have been taken, and it has been impossible to find any trace of any of the stuff.

Representative BATES. Let me ask this question: Since last fall has he been disposing of this or has he been storing it?

Mr. PRICE. He has continued to make disposals.

Representative BATES. If this thing requires a change out to a thousand fathoms it seemed to me we would have required him to put it in storage until such time as he made arrangements.

Mr. PRICE. He had to make arrangements to get storage facilities.

Representative BATES. The thing is either dangerous or not.

Mr. PRICE. That is right.

Representative BATES. If you are not sure, it should be in storage.

Mr. PRICE. Our technical people are sure it is not dangerous.

Representative BATES. Then why are we making the change?

Mr. PRICE. Out of an overabundance of caution.

Representative HOLIFIELD. Is it not true that hazard depends not only upon the intensity of the radiation but upon the quantity?

Mr. PRICE. And the nature of the isotopes that are involved.

Representative HOLIFIELD. I think Mr. Price has said two or three times here when six or seven other people wanted to dump and when the supply of this material builds up and there are other people who want to get in the business this would undoubtedly add additional quantities to the area close in, and it seems to me that the Commission acted wisely in refusing to grant additional licensees in the close-in area.

Mr. PRICE. I think Mr. Bates is saying that we should have gotten him out sooner. We did not until other people wanted to get into the business.

Representative HOLIFIELD. The Chair will recognize Mr. Rogers.

STATEMENT OF HON. PAUL G. ROGERS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF FLORIDA

Representative ROGERS. Our people have been very much concerned in our area in south Florida because one of the recommendations of the study was a dumping site only 3 miles off the coast and the beaches of Florida. Not only are they concerned about the safety factor because we do not know, but an economic factor as well, because of the tourists that might come there and be afraid of going on our beaches if they know that atomic waste may be dumped 3 miles out.

Representative HOLIFIELD. I agree with the gentleman. Regardless of the small amount, the psychological effect would be bad on the people.

Representative ROGERS. That is right. The economic factor involved in a location such as a tourist resort should be taken into consideration.

The Commission has reassured me not only in writing but in the hearings today, and I want to commend the committee for calling this hearing and having the Commission publicly assure us that their present policy is to dump the refuse out 150 miles or 1,000 fathoms deep and that this policy will be continued as far as the foreseeable future is concerned.

I want to tell you that I think that is a very fine policy and, I hope, one that will continue certainly until we have sufficient study to know.

Even in that event you will take into consideration what the Chair said, any economic and psychological factors that would affect the localities near which dumping sites might be selected.

Thank you very much, Mr. Chairman.

Representative HOLIFIELD. You are certainly welcome. The Chair on behalf of the subcommittee, and full committee as far as that is concerned, wishes to say that it has welcomed the appearance here today of the Members of the Congress and Senate that are interested in this problem. We certainly want to assure you that we will keep our eye on this matter in the future.

Representative ROGERS. Thank you, sir.

Representative HOLIFIELD. Proceed, General Luedecke.

General LUEDECKE. Mr. Chairman, I was trying to outline the procedures observed in licensing disposal of radioactive waste in the sea. In addition to the action previously mentioned, a prelicensing visit is made to the applicant by a technical representative of the Division of Licensing and Regulation prior to issuing such a license. The purpose of the visit is to carefully review all aspects of the proposed program with the applicant and to assure that the program can be conducted in accordance with the Commission's regulations and conditions which will be added to the license.

An evaluation is made of the site for packaging and storage of radioactive waste. Attention is given to such factors as the size of the site, nature of surrounding area, and possible effects of fire or flood on the site and the surrounding area. In addition, the applicant's radiation protection procedures, proposed equipment and facilities, method of packaging, container specifications, radiation instrumentation, method and place of final disposal, transportation, and storage are reviewed and discussed. If the visit discloses evidence that certain aspects of the proposed program may not meet the criteria for issuing such a license, these deficiencies are pointed out to the applicant.

The information and technical data submitted by the applicant is thoroughly reviewed by the Commission's technical staff, which includes specialists in the field of radiation protection and waste disposal.

As in the case of Commission disposal operations, in licensing sea disposal of low-level radioactive wastes the Commission uses, as its criteria, its radiation protection regulations (pt. 20, 10 CFR) and the recommendations of the National Committee on Radiation Protection contained in National Bureau of Standards Handbook 58, "Radioactive Waste Disposal in the Ocean." Thus the licenses contain detailed provisions to assure (1) disposal will be in a minimum of 1,000 fathoms of water; (2) the waste material will be packaged in such a manner that under the conditions of handling, storage, and shipment the packages cannot be easily damaged or broken and contains sufficient shielding for protection; (3) the containers will be of sufficient density to reach the ocean bottom without appreciable loss of contents; (4) the package will be appropriately labeled for identification purposes; and (5) containers will conform to applicable shipping regulations of the Interstate Commerce Commission, Coast Guard, and conditions of the AEC license.

Other special conditions are placed on all sea disposal licenses. These include specification of a sea disposal location or reference to one, notification to the AEC before sea disposals are made, and a time

limit for storing the radioactive waste. Also based on the training and experience of the individuals handling the wastes and the equipment and facilities available, certain licensees are not permitted to open containers of waste received from customers but may only package these containers for sea disposal by encasing them in sufficient concrete to obtain the proper density. Because of the widespread interest in ocean disposal of radioactive materials and to keep interested persons fully informed, the Commission publishes in the Federal Register notices of receipt of applications for, proposed issuances and issuances of licenses authorized radioactive waste disposal services resulting in sea disposal.

When a license application is received, a notice of receipt of application is published in the Federal Register. At the time the AEC staff completes its evaluation of the application and determines that the proposed activities meet the requirements for a license, a notice of proposed issuance of the license, the proposed license, and a statement of safety considerations are published in the Federal Register.

Fifteen days are allowed for interested parties to intervene and request a hearing. If there are no requests for interventions, the license is issued as proposed. If an interested party or the applicant intervenes as provided in the Commission's "Rules of Practice" or if there is sufficient public interest demonstrated, the matter is set down for a public hearing. The Commission's hearing examiner presides at such hearings and determines from the evidence adduced whether or not and under what conditions the proposed license should be issued. The hearing examiner's decision is subject to review by the AEC Commissioners on their own motion or, if exceptions to his decision are filed, by any of the parties to the hearing.

In addition, copies of license applications, Federal Register notices, and licenses involving sea disposal are on file in the Commission's public document room for inspection. Copies of the above-mentioned notices and licenses are sent to the Governor and other interested authorities in each State where the applicant will operate.

Representative HOLIFIELD. I think that is a good policy and it certainly puts the Governor of any State on notice that such a license is contemplated, and certainly the department of health and safety in the respective State undoubtedly would have this called to their attention immediately.

Mr. PRICE. We send copies to them.

Representative HOLIFIELD. Copies are sent to them as well as to the Governor?

Mr. PRICE. Yes.

Representative HOLIFIELD. This certainly is not trying to slip anything over on them.

General LUEDECKE. No, sir.

Representative HOLIFIELD. It gives those responsible people in the State the adequate notice which is necessary for them to intervene if they care to.

Mr. PRICE. We have been doing this on reactor licenses from the very beginning also.

Representative HOLIFIELD. I think that is wise, too.

Go ahead, General.

General LUEDECKE. As indicated in the summary of licenses, waste disposal operations which we handed up for the record, hearings have been held on an application by the Walker Trucking Co. and an application by Industrial Waste Disposal Corp.

H.R. 8187: H.R. 8187 is a bill to impose certain restrictions on the disposal of radioactive material in the Gulf of Mexico. It would prohibit the disposal of any radioactive material in the Gulf of Mexico at a point (*a*) less than 200 miles from the shoreline of any State of the United States; (*b*) where the water is less than 1,000 fathoms deep, or (*c*) where the waters are used customarily for commercial sports or fishing.

In addition, it would prohibit the disposal of any radioactive material into the Gulf of Mexico unless the material is in a container of—

such character and strength that it will remain intact indefinitely, regardless of the depth of the water in which it is deposited.

Moreover, if the shipment of radioactive material originated, or was assembled in a State bordering on the Gulf of Mexico, disposal in the gulf would be probited unless permission to dispose of the material had been obtained from the State or an authorized official or agency of the State.

Since receiving the request of the joint committee for comments on H.R. 8187, we have not had an opportunity to prepare detailed comments on the bill, or to present it to the Commission.

I would like to indicate, however, that the Commission staff would not look favorably on the bill. The disposal of radioactive material into the seas (including the Gulf of Mexico), involves detailed considerations of many technical factors. As previously indicated, these include (*a*) the nature and characteristics of the radioactive materials; (*b*) the oceanographic features of the site proposed for disposal, including the ocean currents and the biological characteristics; (*c*) the nature of the packaging methods; (*d*) other technical factors that may be involved in the particular disposal activity.

We believe that such questions can more appropriately be resolved by quasi-judicial and quasi-legislative procedures, subject to the Administrative Procedures Act, as carried out by the Atomic Energy Commission and other Federal administrative agencies. We believe that it would be undesirable to establish by legislation specific prohibitions which would not permit us to continue to take into account the many varying, technical and scientific considerations involved in this complex subject.

Representative HOLIFIELD. Thank you, General, for your statement.

Did I understand you to say that you had an addendum here that you wished to give to us?

General LUEDECKE. We do, sir.

Mr. PRICE. This is a summary statement, Mr. Chairman, discussing briefly each of the licensed sea disposal operations.

Representative HOLIFIELD. That will be included as part of your statement, or added to your statement for the record.

General LUEDECKE. Thank you.

(The document referred to follows:)

SUMMARY OF LICENSING ACTIVITIES RELATING TO DISPOSAL OF RADIOACTIVE WASTES AT SEA

FIRMS PROVIDING COMMERCIAL WASTE DISPOSAL SERVICE

1. American Mail Line, Ltd., 740 Stuart Building, Seattle, Wash., was issued a license in August 1958 to dispose of radioactive waste in the Pacific Ocean. The licensee is authorized to receive waste already packaged for sea disposal only from the Boeing Airplane Co., Seattle, Wash. The licensee acts only as a carrier of the waste from Seattle to the disposal location and is authorized to dispose of this packaged waste in the Pacific Ocean at locations at least 150 miles from the Continental Shelf at a minimum depth of 1,000 fathoms during regular voyages of their ships. To date, this licensee has made one sea disposal consisting of 540 millicuries of byproduct material and 15 pounds of source material at 51°31′ north latitude and 139°00′ west longitude.

2. Coastwise Marine Disposal Corp., 5216 South Van Ness, Los Angeles, Calif., was issued a license in June 1959 authorizing the disposal of radioactive wastes in the Pacific Ocean. The licensee's facilities are located at 2100 West 15th Street, Long Beach, Calif. Containers of waste received from customers may be opened in connection with preparing the waste for sea disposal. The licensee requested permission to dispose of packaged waste in the Pacific Ocean at a location recommended by the State of California and has been so authorized by the Commission. The waste material must be disposed of within a 5-mile radius circle, the center of which is 32°00′ north latitude and 121°30′ west longitude where the ocean depth is 2,000 fathoms. There are five disposal sites in the Pacific Ocean recommended by the State of California which have a minimum depth of 2,000 fathoms and are at least 60 miles from any sea mount. To date, this licensee has not disposed of any licensed radioactive material in the Pacific Ocean.

3. Isotopes Specialities Co., 170 West Providencia, Burbank, Calif., was issued a license in August 1958 authorizing the disposal of radioactive wastes in the Pacific Ocean. Containers of waste received from customers may be opened in connection with preparing the wastes for sea disposal. The licensee requested permission to dispose of wastes in the Pacific Ocean at the locations recommended by the State of California and has been so authorized by the Commission. To date, this licensee has not disposed of any licensed radioactive material in the Pacific Ocean.

4. Nuclear Engineering Co., Inc., 2600 North Main Street, Walnut Creek, Calif., was issued a license in October 1958 authorizing the disposal of radioactive wastes in the Atlantic and Pacific Oceans. The firm's facilities are located in Cowell, Calif., and Kearny, N.J. The licensee is authorized to open containers of waste received from customers in connection with preparing the wastes for sea disposal. The disposal site in the Atlantic Ocean is within a 3-mile radius of 38°50′ north latitude and 72°00′ west longitude or an area bounded by north latitudes 39°00′ and 38°50′ and west longitudes 72°00′ and 72°16′ where the depth is at least 1,000 fathoms. These disposal sites are in the same location as those used by the Commission for sea disposal. In the Pacific Ocean, the licensee requested permission to dispose of wastes at the locations recommended by the State of California and has been so authorized by the Commission. To date, this licensee has not disposed of any licensed radioactive material in either the Atlantic or Pacific Oceans.

5. Crossroads Marine Disposal Corp., 26 T Wharf, Boston, Mass., has been authorized since 1952 to dispose of low-level radioactive waste at an inshore disposal area in the Atlantic Ocean 12 to 15 miles from the coast at 42°25.5′ north latitude and 70°35′ west longitude. The depth at this location is about 50 fathoms. The disposal location is designated as an explosive and toxic chemical dumping area by the U.S. Army Corps of Engineers and therefore one not used for commercial or recreational activities. This license has been amended, effective August 15, 1959, requiring disposal in the Atlantic Ocean at a minimum depth of 1,000 fathoms within an area bounded by 41°38′ and 41°28′ north latitude and 65°28′ and 65°45′ west longitude or within a 5-mile radius circle the center of which is at 38°30′ north latitude and 72°00′ west longitude. This latter area is used by the Commission for disposal of packaged radioactive waste. Containers of waste received from customers may not be opened but only further packaged for sea disposal. To date, this licensee has disposed of about 2,440 curies of byproduct and source material.

6. New England Tank Cleaning Co., 135 First Street, Cambridge, Mass., was issued a license in September 1958 authorizing the disposal of radioactive wastes in the Atlantic Ocean. The licensee's facilities are located at Great Brewster Island, Boston, Mass., and the National Dock Yard, Boston, Mass. Containers of waste received from customers may not be opened but only further packaged for sea disposal. The disposal site is in the Atlantic Ocean within the area bounded by 41°38′ and 41°28′ north latitude and 65°28′ and 65°45′ west longitude where the minimum depth is 1,000 fathoms. To date, this licensee has not disposed of any licensed radioactive material in the Atlantic Ocean.

7. The Walker Trucking Co., 1283 to 1285 East Street, New Britain, Conn., was issued a license in March 1959 authorizing the disposal of radioactive wastes in the Atlantic Ocean. The licensee's facilities are located on Brownstone Avenue in Portland, Conn. Containers of waste received from customers may not be opened but only further packaged for sea disposal. The disposal site is in the Atlantic Ocean within a 3-mile radius of 38°50′ north latitude and 72°00′ west longitude at a minimum depth of 1,000 fathoms. This disposal site is in the same location as that used by the Commission for disposal of packaged radioactive waste. To date, this licensee has not disposed of any licensed radioactive material in the Atlantic Ocean. The licensee has requested an amendment to his license to use an additional site for packaging and temporary storage in New Britain. A hearing is being held on this application for amendment.

8. There are five license applications for disposal of radioactive wastes pending. Applications have been received from Ocean Transport Co., Richmond, Calif., and California Salvage Co., San Pedro, Calif., to dispose of packaged radioactive wastes in the Pacific Ocean. An application has been received from Nuclear-Chem Corp., Bellerose, N.Y., to dispose of packaged radioactive waste in the Atlantic Ocean. Also, an application has been received from the Military Sea Transportation Service, Washington, D.C., to dispose of packaged radioactive waste from Government operations in both the Atlantic and Pacific Oceans. An application from the Industrial Waste Disposal Corp., Houston, Tex., to dispose of packaged radioactive waste in the Gulf of Mexico at 1,000 fathoms is pending review by the Atomic Energy Commission.

ORGANIZATIONS LICENSED TO DISPOSE OF THEIR OWN WASTE AT SEA

9. The National Institutes of Health, of the Public Health Service, Bethesda, Md., was issued a license in May 1959 authorizing disposal in the Atlantic Ocean at a location within a 5-mile radius of 36°56′ North latitude, 74°23′ West longitude at a minimum depth of 1,000 fathoms. This site is approximately 105 miles from Cape Henry, Va. The licensee also receives for disposal properly packaged waste from the Naval Research Laboratory, the National Bureau of Standards, and other Government agencies in the Washington area. The waste is transported to sea by the U.S. Coast Guard accompanied by NIH personnel. To date NIH has disposed of about 30 curies of byproduct material.

10. The U.S. Naval Radiological Defense Laboratory was issued a license in May 1959 authorizing disposal of radioactive waste in the Pacific Ocean at a location within a 5-mile radius of 37°41′ North latitude and 123°25′ West longitude at a minimum depth of 1,000 fathoms or at other areas when approved by the Commission. The location designated is one which has been used by the Commission for disposal of packaged radioactive waste. To date this licensee has disposed of about 100 curies of its own waste.

11. Atlantic Refining Co., Philadelphia, Pa., is authorized to dispose of radioactive wastes in the Atlantic Ocean. The site used is about 180 miles from shore and located at 32°30′ North latitude and 75°45′ West longitude where the minimum depth is 1,000 fathoms. To date this licensee has disposed of about 650 millicuries of byproduct material.

12. Socony Mobil Oil Co., Paulsboro, N.J., has disposed of radioactive wastes in the Atlantic Ocean within an area bounded by 29° and 32°54′ North latitudes and 72°20′ and 77°27′ West longitudes at a minimum depth of 1,000 fathoms and at 25°40′ North 85°17′ West in 1,000 fathoms of water. To date this licensee has disposed of about 1.6 millicuries of byproduct material.

13. California Research Laboratory, Richmond, Calif., has disposed of radioactive wastes in the Pacific Ocean at 30°43′ North latitude and 139°06′ West longitude where the minimum depth is 1,000 fathoms. To date this licensee had disposed of about 1 curie of byproduct material.

14. U.S. Naval Medical Research Laboratory, New London, Conn., is authorized to dispose of radioactive waste in the Atlantic Ocean at a minimum

depth of 1,000 fathoms. To date this licensee has not disposed of byproduct material in the ocean.

15. In addition, the U.S. Fish and Wildlife Service, Beaufort, N.C., and the University of Georgia, Sapelo Island, Ga., are authorized to dispose of very low-level radioactive waste in liquid or readily dispersable solid form directly into the Atlantic Ocean without packaging. The type and quantity of the waste and the immediate dilution involved are such that this waste could be disposed of by sanitary sewer or burial under the provisions of 10 CFR 20, "Standards for Protection Against Radiation." The site used by the Fish and Wildlife Service is about 8 miles off the North Carolina coast at 34°32′ North latitude and 76°40′ West longitude. To date about 500 millicuries of byproduct material have been disposed of at this site. The disposal site used by the University of Georgia is about 3 miles off the Georgia coast. To date about 2.3 millicuries of byproduct material have been disposed of.

16. In addition to the above described licensed waste disposal operations, a few licensed users of byproduct materials disposed of wastes at sea prior to 1958 but are not doing so now. In this group, six organizations dumped a total of approximately 4 curies into the Atlantic, two organizations dumped a total of less than 1 curie into the Pacific and two organizations dumped a total of approximately 10 curies into the Gulf of Mexico. All of the disposals in the Gulf of Mexico and most of those in the Atlantic and Pacific Oceans were at depths of greater than 1,000 fathoms.

17. Thus, to date Commission licensees have disposed of approximately 2,600 curies of radioactive material in the Atlantic Ocean, approximately 102 curies in the Pacific Ocean and approximately 10 curies in the Gulf of Mexico.

Representative HOLIFIELD. Because of the lateness of the hour and some of us have duties in our office at this time we will adjourn for the present time and meet in this room at 10 o'clock tomorrow morning. At that time I believe Mr. Wallen, or Mr. Carritt, of the NAS, will be present. Will it be possible for you to be here in the morning?

Mr. CARRITT. I can be here in the morning.

Representative HOLIFIELD. We will hear you tomorrow morning at 10 o'clock. I notice we have a statement on the desk here from Mr. I. E. Wallen.

Mr. LIEBERMAN. That was included as a part of General Luedeke's statement.

Representative HOLIFIELD. We will include that in the record.

(Mr. Wallen's prepared statement follows:)

OCEANOGRAPHY IN THE ATOMIC ENERGY COMMISSION

(By I. E. Wallen, aquatic biologist, Environmental Sciences Branch, Division of Biology and Medicine, U.S. Atomic Energy Commission, Washington, D.C.)

The Atomic Energy Commission has a limited research program in oceanography and marine biology. Although we have used Navy vessels and the ships of oceanographic institutions for limited periods of time, we do not own ships nor do we employ personnel to carry on oceanographic research. We have not considered this a handicap, since it has been the general policy of the Commission to contract for research as well as services with other agencies and organizations.

Under these circumstances the Commission's interest in open ocean research is restricted to such specialized basic problems as (1) deep ocean currents as a distributive mechanism for radioactivity, (2) dispersal and distribution of fallout radionuclides through the ocean layers, (3) food web concentration of radioactive isotopes in ocean waters, and (4) mechanisms for reduction or dilution of possible centers of radioactivity in the ocean.

The Commission or the Manhattan District has been supporting research in aquatic biology since 1943 when the Applied Fisheries Laboratory of the University of Washington was asked to develop information about the possible effects of the building and operation of plutonium reactors on the Columbia River fisheries. The Applied Fisheries Laboratory has continued these studies to the present time and has also advised the Commission concerning the effects

of the testing program on the biota of the Pacific test site. The Applied Fisheries Laboratory, which is now called the Laboratory of Radiation Biology, was recently selected as a prime contractor to evaluate the effects of the Alaska Harbor project (Chariot) on the surrounding ocean environment.

Although the Commission had long been aware of the possibility of temporary contamination of land and water areas by atomic testing, the heavy yield from the Bravo shot of March 1, 1954, focused attention on the vital need for more adequate oceanographic data to augment the predictions of effects of nuclear detonations on living organisms. The Commission sent several scientists to Japan to discuss the radiobiological aspects of the incident with their marine scientists. A working arrangement was made permitting the exchange of duplicate samples of fishes collected before and after the 1956 and 1958 tests.

The reference here is to the discussion with the Japanese scientists following the March 1, 1954, event in which there was fallout upon a Japanese fishing vessel. Some AEC scientists were sent to Japan to discuss this problem with them.

By the time of the Wigwam detonation off the coast of Lower California in May 1955, the Commission had set up a temporary fish monitoring program at some of the canneries on the west coast of the United States. The Food and Drug Administration, which conducted the monitoring, was able to assure the public that the fishes caught off the coast were not contaminated by fission products.

Because of the paucity of general oceanographic data in the Pacific test area, the prediction of the distribution of radioisotopes from Eniwetok-Bikini was uncertain, and therefore it became necessary for the Commission to sponsor open sea oceanographic surveys in 1955, 1956, and 1958. A Coast Guard cutter was used in 1955 and ships from the Navy and the Hydrographic Office provided transportation for the latter two cruises. Although the data collected during these cruises were favorably received, they pointed up the necessity of continued oceanographic work before a very clear understanding was possible of the environmental forces responsible for determining the effects of detonations on the environment.

In these endeavors the Scripps Institution of Oceanography has assisted the Commission for a number of years in carrying out special studies related to the weapons testing program, including biological oceanographic surveys, especially for the Wigwam operation.

In addition to the release of radioactive isotopes by detonation of nuclear devices, it is obvious that other sources of radioactive materials will become more important to oceanographers. Small quantities of very low level wastes are now being packaged in concrete-filled barrels for disposal at sea. Some low-level (low activity) wastes are inherently associated with industrial uses as well as with the medical research uses of radioisotopes. A part of these wastes from installations convenient to the sea coast are disposed of to the oceans.

Normally operating nuclear submarines and nuclear surface vessels generate low-level wastes in relatively small quantities. The degree of control needed over the release of these wastes to the ocean depends in large part on the ability of that environment to safely assimilate the particular isotopes. It is important that the Navy and the Commission investigate this now when the problem is a small one.

Nuclear powerplants are being used for production of electricity and for research. The irradiated fuel elements from these reactors are highly radioactive and will probably never be disposed to the ocean. However, impurities in the water which may be used in cooling such reactors may pick up a small amount of radioactivity by induction. In this way small amounts of certain radioactive isotopes are in some cases released into streams, depending again on the capacity of the environment, and may eventually reach the ocean.

Although much of the radioactivity in fallout from past testing of nuclear devices will be chemically combined into the land portion of the earth, a larger percentage should fall on the oceans, which comprise about 70 percent of the earth's surface. Likewise, the fallout isotopes may appear in fresh waters, be dissolved from soils and/or be concentrated in waste water from man or industry to eventually go downstream to the ocean, and in this way indirectly add more radioisotopes to the sea.

Although we are confident that early reports are correct that fallout isotopes are insignificant as diluted in sea water, it is necessary to continue monitoring the oceans and to continue research leading to complete elaboration of the oceanic processes that determine the ultimate fate of the long-lived isotopes that may go through the food web in the ocean and again become significant to man.

Support of oceanography is largely dependent upon Federal funds, and the research has been directed toward the programmatic needs of the sponsoring agency. Most of the Navy-sponsored research is related to naval operations and is not applicable to problems of AEC interest. The Bureau of Commercial Fisheries program in oceanography collects some data useful to the AEC from the standpoint of location of sites for waste disposal, but seldom overlaps into the primary interests of the AEC in the health and safety aspects of irradiation. All AEC projects are considered from the standpoint of their relationship to the oceanographic programs of other agencies with which we work closely.

Contracts for research and services have been let jointly with the Office of Naval Research, with the National Science Foundation, with the Bureau of Commercial Fisheries, and with the Maritime Administration for various types of projects, sometimes to be carried out by cooperation with the Coast and Geodetic Survey, the Public Health Service, the U.S. National Museum, the Bureau of Commercial Fisheries, or other governmental agencies. Naval ships and other vessels have often gathered samples for AEC analysis.

Although the Commission has a general interest, as described above, in the potential use of the ocean for disposal of wastes, it is unlikely that other than very minor use will be made of the ocean in this manner. The economics of disposal of wastes seem to point clearly to the use of land disposal sites. In any case the high level, and consequently more dangerous wastes, are stored in underground, steel tanks on land. Current research on processes for treating these wastes to make them safer to handle and use are all pointed to some method of storage or disposal on land. Dr. Lieberman undoubtedly will discuss the subject at greater length.

The Commission is primarily interested in the development of uses of radioactive isotopes that may contribute substantially to the rund of scientific knowledge; for example, the production of more food from the oceans. The value of tracer quantities of radioactive materials in the solution of problems of living functions of organisms can hardly be overemphasized.

Oceanographic assistance, principally in the way of conferences, has been given by the Commission to Japan, to Canada, to the United Kingdom, to the International Atomic Energy Agency, and to other countries and groups of countries. It is anticipated that such cooperation must continue, since obviously the ocean cannot be separated into isolated compartments for study or for use.

It has been estimated that in case of a nuclear war one of the least contaminated sources of food will be the sea because of the tremendous volume of water that, through natural mixing processes, will greatly reduce the concentration of added contaminants. It is obvious that studies must be undertaken to assess more accurately the level of radioactivity that may be absorbed by the ocean without detrimental effects.

It has been pointed out (NAS-NRC Publication 551) that the concentration of certain elements by organisms, along with gravitational effects on their excreta and dead remains, as well as their migrations, result in a circulation of these elements that is different from the circulation of the water.

In other words, the distribution of radioisotopes in the ocean cannot be predicted solely from knowledge of the currents, as the biota play an important part in the distribution of radioisotopes in the ocean.

A number of elements are concentrated in the bodies of organisms by several orders of magnitude over their abundance in sea water. Radioisotopes of some of these elements may be concentrated in man's aquatic foods. Ion exchange and sedimentation of particulate matter will remove some radioisotopes; however, in near shore areas these may be recycled by bottom feeding organisms.

The general outline of the Commission's research efforts concerned with radioactivity in the ocean was suggested by the National Academy of Sciences Report on Oceanography, 1960–70, and inserted in the Congressional Record of February 17, 1959. We previously presented two papers covering the broad aspects of this program to the Joint Committee on Atomic Energy (fallout hearings May 5–8, 1959). These two papers were, first, "The Atomic Energy Program in Oceanography and Marine Biology," prepared by Dr. I. E. Wallen, aquatic biologist, Division of Biology and Medicine, U.S. Atomic Energy Commission. This paper was presented as appendix C of the statement on fallout prepared by the Director of the Division of Biology and Medicine, Dr. C. L. Dunham.

The second paper was entitled "Fallout in the Ocean," and of this paper Dr. Allyn Seymour was the author.

The specific objectives of the various aspects of the Commission's research program will now be given.

One of the objectives of the Commission's research is to determine the effects of the accumulation and retention of fission products on marine organisms and their transfer along the food chain to those higher species used as food by man. Problems of the effects of severe radiation on fishes are also studied. Such studies are of considerable magnitude when one considers the possible hundreds of organisms and at least 24 isotopes of significant occurence as fission products.

I should like to include here a chart, which was adapted by Chipman (1958) from data of Hunter and Ballou (1957) showing the percent of total radioactivity contributed by certain fission products at different times after fission (table I). This table has been prepared as a chart, but rather than present the chart at this time, reference will be made to table I.

The significance of the table is that it shows the sort of isotopes that biologists look for when they are looking for fallout-contaminated organisms. It is also significant in that it points out that the relative abundance of these various isotopes changes with time. At a certain time after the origin of the radioisotopes, one isotope may be important, but at some later time some other isotope may be relatively more important.

I think it obvious from the table that strontium 90, cesium 137, and cerium 144 are some of the important radioisotopes after 3 years.

In addition to the radioisotopes from fission, other radioistopes are also produced by the detonation of nuclear devices or the operation of nuclear reactors. These include zinc 65, cobalt 57, 58 and 60, iron 55 and 59, manganese 54, phosphorus 32, copper 64, chromium 51, and arsenic 76—all of which are important biologically.

Since many of the elements are present in trace amounts, we have found it necessary to study the chemical composition of biological organisms. It has been demonstrated that plankton organisms will accumulate large concentrations of mixed radioisotopes. If we were looking for an area in the ocean to see if it had been contaminated by fallout, the easiest way to do this at the present time is to collect a sample of plankton and examine the plankton for radioactivity.

As a result, the Commission has developed a detailed program to discover the effectiveness of these organisms, both from the standpoint of decontamination and that of possible transfer to human food organisms. Some expansion is necessary in the fiscal year 1959 expenditure of $170,000 for this type of research.

A second objective is to evaluate the disposal and transport of elements by the physical processes of mixing and currents; by the geochemical processes of adsorption, sedimentation, and accumulation in locations where they may be absorbed by bottom dwelling populations; and finally by biological transport through accumulation in living matter and the subsequent migration, horizontal and vertical, of the populations. Many kinds of experiments must be designed and completed before the answers are known here.

When radioactive materials enter the oceans they may go into solution, they may precipitate or coagulate, they may interact to attain colloidal size, they may be adsorbed or absorbed by other particles, they may settle to the bottom, or they may be ingested by organisms and enter into the biochemical cycle.

Whatever the state of suspension or removal from the water, radioelements will be subject to physical forces that affect their ultimate distribution. Horizontal and vertical currents may transport the isotopes until they reach a water density level that temporarily or semipermanently stabilizes them. Diffusion processes tend to equally distribute the added elements among those already present. Migrating animals ingest the particules, excrete them, die, or are eaten by other animals to modify the tendency toward homogeneity of distribution.

Some of the radioactive elements are needed by organisms and, because the normal elemental supply is low, these radiochemicals are concentrated, perhaps 1 million times over their abundance in sea water. In other words, if the organism living in the sea has a physiological demand for an element that cannot be satisfied by the elements which are already present in the sea, and a radioisotope of this element is added to the sea, then naturally the organism will take up the radioisotope of this element.

Other elements are avoided or discriminated against by organisms.

Sedimentation processes may carry heavier elemental particles, adsorbed radiochemicals and dead organisms with contained radionuclides toward the bottom of the sea where they may be permanently incorporated into the sediments or removed by bottom feeding organisms.

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Since research in these subject fields often requires ocean trips of some magnitude, such research is costly. The Commission is spending approximately $300,000 on a minimum program which we propose to expand during fiscal year 1960.

A third objective of the Commission in oceanography is to maintain a control and monitoring program to assure that the utilization of atomic energy has not resulted in dangerous contamination of the environment. As has been previously mentioned, the Commission has made oceanographic surveys of the Pacific test site before and after each test series. Samples are also collected between testing programs as practical. A large collection of organisms was taken from the central Pacific before any testing was initiated. The Navy and the Commission have provided these organisms for the Smithsonian Institution to assemble and identify and make them available for comparison with samples collected later.

Biological samples of organisms from Thailand, Japan, Palau, Guam, and other sites have been taken frequently to document the distribution of radioactive isotopes from the Pacific. Samples of ocean water from the north and south Atlantic Ocean, from the Arctic and Antarctic Oceans, and from the Indian Ocean, have been analyzed for radioactive isotopes to provide data on the minute quantities of isotopes present in the oceans from fallout. In some cases 150 gallons of water must be collected in order to locate from 1–30 disintegrations per minute of strontium 90—present as one part per billion billion parts of water.

The amount of contamination that is added to the water can be detected by radiochemical means, but not by weighing. The contamination is an extremely small part of the ocean water.

Since by weight 1,000 grams of sea water normally contain an average of 34 grams of dissolved materials of at least 44 elements, it is no easy chore to identify and measure accurately the trace amounts of radiochemicals that appear in the water. The production of radiochemicals from some individual detonations can be identified, however, and the progress of their diffusion followed across the Pacific.

Following the 1954 test series at Bikini-Eniwetok, a vessel from the Coast Guard was sent on this sort of mission. This was about 10 months following the end of the 1954 series. At that time the highest levels of radioactivity were found about 3,000 miles to the westward of Bikini-Eniwetok off the coast of the Philippines. The levels of activity here were about one-fourth that of the naturally occurring radioactivity in sea water.

In connection with the monitoring of fallout chemicals, we expect to learn about oceanography from a number of aspects. Circulation of ocean currents can be measured directly by appraisal of directional differences in rates of dispersal. Questions of exchange of chemicals between thermal layers and between water and sediments may be solved using radioisotopes.

In addition to the monitoring of fallout, the AEC program is aimed at establishing operating criteria for both radioactive waste disposal (packaged low level wastes) and nuclear ship operations, and this is being done in cooperation with several other governmental and private agencies.

The investigation of waste disposal sites has been developed under close guidance of the National Academy of Sciences Committee on Oceanography. A subcommittee has just released its first report, "Radioactive Waste Disposal Into Atlantic and Gulf Coastal Waters," and a report is being prepared for the Pacific coast. In addition to these formal reports, the advice of the committee has been sought at several meetings to develop a sound program for selecting and monitoring waste disposal sites. These meetings have been held with the cooperation of the Coast and Geodetic Survey, the U.S. Public Health Service, and other interested organizations.

A study of New York Harbor to predetermine the fate and effect of any released radioactivity is now underway. It is jointly financed by the AEC (approximately $180,000 fiscal year 1959) and the Maritime Administration (approximately $200,000 fiscal year 1959). As an extension to the New York

Harbor study, models of harbors are utilized for similar dispersion studies by the Corps of Engineers at Vicksburg, Miss. This latter work is being done in cooperation with Maritime Administration as a part of the nuclear ship project. AEC plans to expand the harbor studies in the next year or two including studies using tracers in the actual harbors.

Similar studies may be undertaken by the Navy Bureau of Ships in connection with the nuclear ship program. During fiscal year 1959 the AEC-sponsored studies ($25,000) of two possible sea-disposal sites; in fiscal year 1960 additional, similar studies costing $100,000 are planned. Work will be carried out by the Coast and Geodetic Survey and the U.S. Public Health Service. Right now it is difficult to say with any precision just how much will be spent on coastal and estuarine studies in the next 2 years. It is anticipated that AEC will support approximately $200,000 in fiscal year 1960 and the Maritime Administration approximately $115,000 in connection with the operation of the NS *Savannah*. Undoubtedly, the total program will be larger as other agencies undertake studies. In addition, the fallout monitoring program includes an expenditure of about $200,000.

A fourth objective of Commission research aims to provide information concerning the natural radioactivity and normal processes of oceanic distribution of radionuclides. The uptake of radiochemicals is dependent upon the concentration of tracer chemicals and normal chemicals in the environment. Radium, uranium, and thorium, are normally found in ocean sediments. Carbon 14 is a natural component of ocean waters. Potassium 40 is also a natural component of ocean waters. The long half lives of these radioactive chemicals permit a look backward to past conditions and thus provides data of value in predicting future distribution of elements in the sea.

It has been found that certain natural compounds which are formed in the deep sea will chelate thorium and other radiochemicals.

The problem here is a large one. It is a matter of determining the genetic effect of low levels of radiation upon marine organisms. We know what the effects of high levels of radiation upon marine organisms are. Some of the early work of the Applied Fisheries Laboratory was directed toward the study of the effects of X-rays upon fish, principally salmon and trout, and upon snails, upon plankton, and other aquatic organisms. The effects of high-level radiation are well known, but the effects of low levels, the sort of levels of radiation that exist currently in the waters of the ocean, are not known.

This is an area in which we need information, but it must be recognized that this is an area that will require considerable effort. It is not a problem which can be solved easily.

Determination of age of ocean waters by the use of radiocarbon and other radiochemical decay increases our understanding of ocean currents and assists in prediction of the diffusion rates in the case of a nuclear accident or detonation of a nuclear device. Radiocarbon also provides a useful tool for measuring rates of production of organic matter in the sea.

Studies of the basic processes of metabolism of oceanic organisms have been extremely difficult and it is anticipated that great progress can be made in understanding these processes by the use of radioactive tracers. This may be illustrated by listing some of the biological benefits which may accrue from circulation of the ocean waters. Such benefits include (1) oxygenation of subsurface water; (2) dispersal of excreta; (3) distribution of nutrients, and (4) dispersal of spores, eggs, larvae, and many adults. Controlled experiments on a sizable scale may be developed when the equipment necessary for extremely low level counting is adequately designed for oceanic use. Small experiments conducted to date have been very encouraging.

Studies in the open ocean involve the use of larger research vessels. Rather than purchase its own ships the Commission considers that it should pay an operating agency—i.e., Navy, Coast and Geodetic Survey, Bureau of Commercial Fisheries, or a private organization—for ship time to gather pertinent data.

The fiscal year 1959 level of Commission expenditures toward research of this nature is about $300,000. It is planned that such expenditures will increase.

TABLE 1.—*Percent of total radioactivity contributed by certain fission products of biological interest at different times after fission*[1]

	20 days	90 days	1 year	3 years	10 years	20 years
Sr^{89}	5.0	10.5	2.7			
Sr^{90}, Y^{90}			3.7	17.4	44.0	48.0
Y^{91}	5.6	12.5	3.8			
Zr^{95}	5.9	14.7	7.2			
Nb^{95}	2.3	18.0	14.7			
Mo^{99}	1.3					
Ru^{103m}	4.4	7.2	.8			
Rh^{103}	4.2	7.0	.8			
Ru^{106}, Rh^{106}			4.9	6.0		
I^{131}	5.6					
I^{133}	1.1					
Cs^{137}, Ba^{137m}			2.9	13.6	36.0	45.0
La^{140}	13.9	1.8				
Ba^{140}	12.0	1.6				
Ce^{141}	9.7	8.5				
Pr^{143}	12.0	11.2	2.6			
Ce^{144}, Pr^{144}	2.6	12.0	52.8	42.0		
Nd^{147}	5.0					
Pm^{147}			5.7	19.0	16.0	3.4
Sm^{151}				1.1	2.5	2.6

[1] Adapted from data of Hunder and Ballou (1951). Reference, Chipman (1958).

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Representative HOLIFIELD. How long is your statement, Mr. Carritt?

Mr. CARRITT. It would take 17 or 18 minutes to read, and I have a few editorial comments to make as I go along.

Representative HOLIFIELD. I believe we will revise our ideas of adjourning and hear you now, because you are the last witness that has been asked to testify. I know of no further witnesses. I think we will be able to conclude the hearings this afternoon.

STATEMENT OF DAYTON E. CARRITT, OF JOHNS HOPKINS UNIVERSITY

Mr. CARRITT. My name is Dayton Carritt. I am associate professor of oceanography at Johns Hopkins University. I am here in behalf of the National Academy of Sciences National Research Council, because I was the chairman of the working group that formulated

publication No. 655 that has been discussed here today. I have two things to say: One, I would like to have in the record a short statement concerning the National Academy of Sciences study panel and how it fits into the overall operations.

This is essentially background information on the position of the National Academy in the development of atomic energy. The National Academy of Sciences National Research Council is a private nonprofit organization of scientists. The Academy was established in 1863 under a congressional charter signed by President Lincoln, empowered to provide for all activities appropriate to an Academy of Sciences. It was also required by its charter to act as an adviser to the Federal Government in scientific matters. This provision accounts for the close ties that have always existed between the Academy and the Government although the Academy is not a governmental agency. The National Research Council was established by the Academy in 1916 at the request of President Wilson, to enable scientists generally to associate their efforts with those of the limited membership of the Academy in service to the Nation, to society and science at home and abroad.

The members of the National Research Council receive their appointments from the President of the Academy. They include representatives nominated by major scientific and technical societies, representatives of the Federal Government and a number of members at large.

In addition, several thousand scientists and engineers take part in the activities of the Research Council through membership in its various boards and committees. The Committee on Oceanography was organized in 1957 within the Division of Earth Sciences of the National Academy of Sciences National Research Council. It was organized at the joint request of the Atomic Energy Commission, the Bureau of Commercial Fisheries, and the Office of Naval Research. The National Science Foundation has since joined the group of sponsors.

In January 1958 the sponsors of the committee jointly forwarded a request asking that the Committee on Oceanography organize a special study on the disposal of low level atomic wastes into coastal Atlantic and gulf waters. This work was undertaken by the committee as a part of a continuing series of studies of similar problems.

In February 1958, Dr. Roger Revelle, chairman of the Academy Committee on Biological Effects of Oceanography and Fisheries, formed the following working group to study the problem:

Dean F. Bumpus, Woods Hole Oceanographic Institution; James H. Carpenter, Johns Hopkins University; Walter A. Chipman, U.S. Fish and Wildlife Service; John H. Harley, U.S. Atomic Energy Commission, Bruce C. Heezen, Columbia University; Bostwick H. Ketchum, Woods Hole Oceanographic Institution; Robert O. Reid, A. & M. College of Texas; Howard Eckles, Department of the Interior; Arnold Joseph, U.S. Atomic Energy Commission; and myself, Dayton E. Carritt as chairman.

Subsequently the report was carefully reviewed and fully endorsed by the Academy's Committee on Oceanography and the Committee on Biological effects of Atomic Energy Radiation on Oceanography and Fisheries.

Perhaps I should preface my statement here by saying that in my opinion right now there ha s been a great deal of misunderstanding about what the National Academy's report says. It seems to be an understanding that we are recommending that disposal be started in the areas that are designated in that report.

I would like to emphasize and to do it as many times as I can, to insure you that report does not say that we suggest that you go to those locations and dump radioactive materials.

As a matter of fact, I am sure that the study group would be the first to object to such procedures. The thing we have done in the report is to outline in as much detail as we can the kind of things that will happen to bring radioactive materials from any disposal site in the sea back to man. We have put quantitative information in this route from the disposal site back to man, and have come up with what you would call a time-space relationship which says if you do things generally in the oceans within these relationships everything is going to be all right.

We now also say we are slightly ignorant of some of the details that take place along the coastline. So we say that although these locations that we specify in the report look reasonable, we say that they should be looked at, they are locations that should be studied before anything happens.

Senator PASTORE. How did you come to choose these particular locations? I am specifically referring to the three in Rhode Island.

Mr. CARRITT. Only that they are locations that have been used for disposal operations. They were, so far as we could tell, locations that were outside of the normal flow of commercial fisheries, which is the main source of interference that we can see. We said let us look at these locations, and if they meet a certain set of specifications, we would recommend they be used.

Senator PASTORE. What test did you make?

Mr. CARRITT. That is the body of the report. If you will allow me, I will read a summary of that into the record.

Senator PASTORE. Before you get into that, another thing I might say very frankly to you, Professor, that added to the existence of apprehension on the part of the people because there is a tremendous psychological reaction on a matter of this kind whether it is based on fact or upon suspicion, there was this added feature that after your report was made and after the furor took hold you abandoned two sites.

Mr. CARRITT. Your timing is not quite right.

Senator PASTORE. You time me better, if you will.

Mr. CARRITT. I can carry you along as I saw it. Our report was released for publication, as I remember it, some time early in June. I think it was 15th of June. The date escapes me. There was a press release that explained in rather broad detail what the scientific work said in layman's terms. We felt there should be no hysteria associated with this.

On June 19 and 20 we had a meeting in Woods Hole, Mass., a meeting of the committee plus 10 or 15 other scientists who represent local areas there. The Fish and Wildlife Service people and people from the State. This was to discuss specifically what should be done by way of a survey in the areas designated in the report along the Atlantic coast. This was at a time before we heard of any furor at all.

It was brought to our attention by the people of the Fish and Wildlife Service in Woods Hole that indeed the two locations you mentioned were in a fishing area. So we said this is the kind of information we want turned up and on the basis of this we will suggest that they be dropped.

This is the kind of information we are after. We are looking now for detailed information about each one of these locations to see if we can decide whether or not they should or should not be used.

Senator PASTORE. At any rate, it is fair for me to assume that your decision to abandon these two locations was predicated upon the fact that it would be disturbing to the fishing activities there, and all you are saying is that it was not as a result of the furor that might have been created.

Mr. CARRITT. That is true.

Senator PASTORE. Nevertheless, irrespective of the furor, you reached the conclusion that it would be disturbing to the fishing activities and for that reason you thought it best to abandon those two locations?

Mr. CARRITT. That is correct.

Representative HOLIFIELD. By disturbing, I wish you would clarify that.

Senator PASTORE. I do not mean contamination.

Representative HOLIFIELD. No, but I would like the record to show.

Mr. CARRITT. I think this is an important thing. We considered that it would not be a hazard to fish or to fish that would be eaten by man. We considered that it was primarily a nuisance hazard to fishermen because of the piling up of 55-gallon drums on the bottom and the subsequent tearing up of their fishing gear. Rather than subject the fishermen to this kind of hazard we will find a place where they do not fish.

Representative HOLIFIELD. Did you go beyond the physical interference with fishing implements and consider at all the economic reaction of the fish buying public in that area?

Mr. CARRITT. We thought of it. I knew of no way and I don't believe anybody in the study group had any way of evaluating, in the way you would evaluate a radioactive hazard, the psychological problems.

Representative HOLIFIELD. If you will remember at one time when there was some contamination of the fish life due to some bomb tests that the Japanese people—shortly after the test which contaminated the *Lucky Dragon* fishing ship—there was a regular boycott of fish for several days or maybe weeks by the Japanese people who depend upon fish for the major part of their protein.

In the selection of these sites I think you must go further than the physical interference or the possibility of contamination. At least call attention to the fact that you have not taken into consideration the effect upon the tourist industry of Florida, for instance, the purchasing of shrimp in the Gulf of Mexico, the purchasing of lobsters off the New England coast and that sort of thing. That has to be taken into consideration. It is just as real and tangible, while it may be intangible from the standpoint of scientific scrutiny, that must be considered in danger to the life of the people.

Senator PASTORE. It could ruin the economy of an area. I remember when I was Governor of Rhode Island there was a proposal that

was made—there were people who disagreed with me then and disagree with me up to this moment—they selected a site for the foot and mouth laboratory on Prudence Island. I was Governor of the State at the time and I resisted it with everything within my power because psychologically it would have created havoc in my State. While we are a small State in area we have the largest population per square mile of any State in the Union. We are congested. There is no question about it at all. We use our facilities for recreational purposes. Even the President of the United States comes that way for his summer vacation at Newport, R.I. That is the only natural resource we have, Narragansett Bay. You can imagine a dumping ground of an atomic waste in an area congested like that, even though there be no foundation for fear, the suspicion alone would be enough to ruin the economic stability of the community.

Representative HOLIFIELD. I think probably in talking to one of the scientists who made this study we might be going beyond their particular function in the case.

Senator PASTORE. I realize that.

Representative HOLIFIELD. This would probably be the decision of the AEC to take into consideration these extra-scientific factors.

Senator PASTORE. I will give you an idea what happened in my State, although you are not to be blamed, because your research is predicated upon scientific research and opinions. We have two editorials in Rhode Island. One was, "Why Dump Nuclear Wastes Off Our Shores?" You can imagine what that did to the people in our State. As a matter of fact, one of the local radio stations that has one of these "call up and state your gripe," programs wherein they challenge the people to call up and state their gripe about what this would do to our community. I realize that this is not one of the factors you take into account, but much was made of the fact that you decided to abandon two of the locations. I will tell you very frankly that the argument was used against your decision in the first place to accept those two.

Let me ask you this question, which I think is more apropos to your testimony and to the work that you conducted here.

As you sit there now, you are in no position to say that as far as you have gone in your research of this subject and the selection in choosing these sites that this is foolproof insofar as hazard is concerned. Is that correct?

Mr. CARRITT. Senator, you are absolutely right. If you will permit me to make a short statement here with regard to that, I have a rather strong feeling about this. A good many people have come to me since publication of this report and have admitted they have not read it and have ended up in a discussion by saying, "I hope you have made absolutely sure that there will never be a radioactive atom get into our waters. I have assured them that there is nothing of the sort there. It is impossible to assure anybody that that will not happen. When the decision was made by this country or by any other country to embark upon a program involving fission products, it was at that point that we lost that decision. From now on it is absolutely impossible to say that we cannot have any contamination in the human environment. The only possible question you can ask now is, How long can we keep it? How much time, money and effort can we expend to keep the contamination down to a permissible level?

First of all, find out what that permissible level is and then keep it down. The more money you want to put out over and above that, the lower it is going to go.

Senator PASTORE. Is it not a fact that the deeper you go, the safer it becomes?

Mr. CARRITT. The deeper? I don't know what you mean.

Senator PASTORE. I mean the disposal of the waste.

Mr. CARRITT. You mean the deeper in the ocean?

Senator PASTORE. The deeper in the ocean the less the hazard.

Mr. CARRITT. I don't agree with that.

Senator PASTORE. You mean to tell me it is the same dropping it in 5 feet of water as 5,000 fathoms?

Mr. CARRITT. I don't mean that at all.

Senator PASTORE. I realize I am giving an example of extremes but I have to make the point. You mean to say it is as safe to drop it in 203 feet of water, which is the designated site off Rhode Island as it is in 5,000 fathoms?

Mr. CARRITT. I would say we know more about inshore circulation features and about inshore biological processes than we know about deep sea circulation and deep sea biological processes. Right now we can sit down and put numbers to processes that are going along certain shore areas where we have no idea what is going on in the deep ocean merely because we do not have the instruments to make these measurements. From the standpoint of putting it on the bottom close by here, in such a way that we can keep track of it, I think it is much safer to do it that way than sticking it out in deep water.

Senator PASTORE. I realize that. Is there not a school of thought that if you go down deep enough there are some spots at the bottom of the ocean that are so deep so that there is no life at all?

Mr. CARRITT. No, sir; I think that is not accepted by any reputable oceanographer today.

Senator PASTORE. Was it ever accepted?

Mr. CARRITT. It was at one time; yes, sir.

Senator PASTORE. When was it exploded?

Mr. CARRITT. As a matter of fact, when Mr. Darwin went around the world. He probed deeper and deeper. Before Darwin's time it was thought that life did not go down below where sunlight penetrated or where man could swim to. We have been gradually going down so now we have samplings in the deepest part of the ocean and indeed there is life there.

Senator PASTORE. It was always my understanding—I don't mean to challenge you in a field where you are an expert and I hope you do not misunderstand me—that the reason why we went to a thousand fathoms was because the deeper down in the water you went the more shielding you got and the less the hazard involved.

Mr. CARRITT. I think the reason for the thousand fathor figure that appears in Handbook 58 are two, actually.

When that handbook was generated and when the thinking that went into that handbook took place, people were thinking in terms of a few curies. Most of the people that did the thinking there had the feeling that a few curies was going to kill everybody in the country. I think probably there was a little bit of hysteria in the group that wrote it. Their feeling was that if we get it away from us a thousand fathoms or more we are done with it. Also, there was and there

still is a very good reason for picking a thousand fathom number for some purpose, and that is that there are no commercial fishing operations going on beyond a thousand fathoms. If you come closer than a thousand fathoms then you must take into consideration the fishing operations either from the standpoint of a nuisance or the standpoint of the contamination of the fish.

Representative HOLIFIELD. And the edible fish life because when you go to a thousand fathoms there are no fish that live at that level which are ordinarily consumed by people.

Mr. CARRITT. That is right.

Representative HOLIFIELD. Therefore, the life that does exist at that depth would not be so liable to become contaminated as a food source for the people. I am assuming that plantington and algae that the fish feed on are not found at that level.

Mr. CARRITT. That is reasonable.

Is it your wish that I read this statement now?

Representative HOLIFIELD. Yes, you may proceed.

Mr. CARRITT. The study group which is composed of experts in the field of marine biology, submarine geology, chemical oceanography, physical oceanography, circulation of coastal waters, health physics problems as related to radioactive materials, and certain aspects of commercial fisheries met several times to discuss the problems and called upon other people whom we felt could aid in our studies.

I would note here that all of the study group members are employed full time in activities other than National Academy of Sciences committee functions. Four of us are members of university faculties, two are staff members in a research institution and two are Government employees. We receive no financial rewards for our work—the only financial transaction being reimbursement of travel expenses plus a per diem which at times does not cover normal living expenses. I insert this note here because the opinion has been expressed that eight experts working for a year and a half should have more to show for their efforts than the publication reporting the results of our study.

The results of our work have been published by the National Academy of Sciences-National Research Council as publication 655 entitled "Radioactive Waste Disposal in Atlantic and Gulf Coastal Waters." Since publication of this document I have heard a considerable amount of comment concerning our recommendations and recently the unfavorable comment has reached a peak with publication in newspapers of opinions which convey the idea that the National Academy of Sciences National Research Council study group was uninformed, acted in a capricious manner, and made recommendations which if followed would create a hazard to the people of the United States, and that I as chairman of the study group have insulted the American people and their elected representatives.

I think that is the content of the clippings you have just shown me, which I have seen.

As chairman of the study group and as a responsible citizen I am deeply concerned about this turn of events and am pleased to have the opportunity to explain how we came to the conclusions stated in publication 655, exactly what our recommendations mean and, probably of nearly equal importance, what they don't mean.

First let me note that since the release of publication 655 I have heard no objections made by a reputable scientist to the basic ap-

proach to the waste disposal taken by our study group nor to the recommendations based upon our study.

I should mention that I have received one letter from Dr. Hargis, Director of the Virginia Laboratory. He has objected to one location off the Virginia coast. I think his objection is scientifically not valid. He is not doing it in a hysterical manner. He says "I object for the following reasons. Will you discuss it."

Representative HOLIFIELD. I think there has been very little hysteria. I think we have used that word several times today. It is not quite the right word. There has been concern. I don't think there has been any hysteria. There has been public concern. I think a great deal of public concern does stem from the fact that they do not realize in reading the newspaper articles that we are watching this problem closely. The scientists, AEC, this committee and many other people are watching it.

Proceed.

Mr. CARRITT. Furthermore, in every case of objections by nonscientists that I have personally checked, the persons doing the objecting admitted that they had not read publication 655, but were basing their opinions upon newspaper accounts of the report. Some of the newspaper accounts that I have read have been, at best, a garbled report of the actual situation.

Very briefly, the study group recommended procedures for the disposal of packaged, low level radioactive wastes, with very well defined limitations, which if followed, would under the most unfavorable, most highly unlikely, combination of events expose the people of this country to radiactivity at a level no greater than now permitted in drinking water. Furthermore, because of the several factors of safety we intentionally included in our calculations it has been estimated that the exposure produced by disposal according to our recommendations would very likely be a thousand times less than the permissible drinking water levels.

I should note for you the limitations on the powers, responsibilities, and duties of the group that produced publication 655. We are a study group of the Committee on Oceanography of the National Academy of Sciences. The National Academy is a private, nonprofit organization of scientists. It is required by its charter to act in an advisory capacity to the Federal Government in scientific matters but does not directly establish policy for governmental agencies. Publication 655 then is not necessarily official policy of the AEC or the Fish and Wildlife Service. However, the conclusions and recommendations may be used in formulating policy regarding the disposal of radioactive waste into the ocean. If this is done we believe that the health hazard so produced will be less than that presently permitted in drinking water.

Basically, we were asked to answer one question, "Can the inshore waters of the Atlantic and gulf coasts be safely used as receiving grounds for radioactive wastes?" Our answer is: "Within stated limitations radioactive wastes can be safely disposed of into Atlantic and gulf coastal waters." I emphasize that our primary concern was human safety. We also considered, however, possible interference of disposal operations with other uses of the coastal waters. For example, the piling up of disposal containers on the bottom in an area that is used by draggers—fishing operations in which the catching gear

is dragged along the bottom, would set up obstacles that might damage a fisherman's equipment. We have already eliminated two suggested sites for this reason.

Our criterion of safety was that used in establishing the maximum quantities of radioactive substances permitted in drinking water. These are limits that have been suggested by the International Commission on Radiation Protection, have been subscribed to by our own National Committee on Radiation Protection and National Bureau of Standards, and have been published by the Bureau of Standards in Handbook No. 52. It should be noted that should the values given in Handbook No. 52 be changed, and they undoubtedly will be, it may be necessary to change the limits of quantities and rates of disposal recommended in publication 655.

I would emphasize that none of our conclusions and recommendations are based upon or modified by cost consideration, either of marine disposal per se or of marine disposal in competition with land disposal. By this I do not imply that costs should not be considered, only that we were asked to consider safety. Comment reported in one newspaper states that the only consideration in selecting disposal at sea rather than on land was the relative costs.

Representative BATES. Doctor, when you refer to the limits and compare them to drinking water, you do take into consideration, I assume, the possibility of converting salt water into drinking water.

Mr. CARRITT. That was talked about. With the kinds of isotopes that are being disposed of, there is no danger if the sea water meets drinking water standards. In a conversion process that will give you drinking water there is no increase in the contamination.

It should be borne in mind that we have been concerned with packaged low-level wastes—and I emphasize the terms "packaged" and "low level." These are wastes that are generated in research laboratories, in industrial testing facilities, and in hospital uses of radioisotopes. They may be compounded of a variety of contaminated trash materials in which the activity is of the order of millicuries per gallon. We are in no way concerned with the disposal into the sea of the megacurie quantities of activity generated as fission products in nuclear powerplants. We have estimated that approximately 120 curies of a variety of isotopes with half lives over 1 year were produced at Oak Ridge National Laboratories in the period January 1956 to September 1957 and used in such a way that they might have been disposed of at sea. During the same period an estimated 25 curies were disposed of at sea.

Let me outline very briefly for you the methods by which we arrived at the conclusions and recommendations in National Academy of Sciences National Research Council Publication 655. As mentioned above, the separation of safe from unsafe procedures depends upon radiation exposures less than or in excess of the values given in the National Bureau of Standards Handbook No. 52.

A procedure which will give us exposure equal to or in excess of the maximum permissible values in the handbook was considered unsafe. As far as we could determine, there are only two ways in which the disposal of radioactive materials into the sea can produce a hazard to man. The first is by transport of hazardous amounts of the waste when the disposal container has corroded away and released the waste to the sea, to a shoreline used primarily as a recreation

facility where merely by proximity to the water man could receive damaging exposures of radiation. This is a matter of a hazard by external emitters. The second is by eating marine food products that have become contaminated by living and growing in contaminated water. Here we are concerned with internal emitters that have been taken into the body in food and drinking water.

It turns out that if we can satisfy the case of the contamination of marine food products we will have automatically solved the external-emitter case.

As noted above, the National Bureau of Standards Handbook No. 52 values of maximum permissible exposure to various isotopes was used as the basis for separating safe from unsafe procedures. From the listed values it is possible to compute the maximum quantity of any isotope that can be taken into the body in any stated interval of time. For example, the listed maximum permissible concentration of strontium 90 in drinking water is 8×10^{-7} μc/ml, from which we compute a maximum permissible weekly ingestion rate as 1.2×10^{-2} μc, assuming man drinks 15 liters of water a week.

If in using these numbers you wish the record to show an expression in some other form, that might be better understood by people other than yourselves, I would be very glad to change the wording.

Representative HOLIFIELD. The staff may get in touch with you on that point.

Mr. CARRITT. Yes, sir.

In other words, so long as man takes into his body less than $1.2\times10^{-2}\mu$c of strontium 90 each week, no biological damage will result. We now assume that man's entire protein supply comes from marine fish and shellfish. This introduces a factor of safety since the average protein consumption is approximately 3.3 pounds per week, whereas the average fish consumption is approximately 10 pounds per year or 0.2 pounds per week.

Mr. RAMEY. In making your calculations, do you take into account any other source of radioactivity that a person might get from the ocean or otherwise? For example, there is fallout that hits the water. Then there are other factors that affect humans on land.

Mr. CARRITT. No, sir; we have not. As a matter of fact, the study group in its last meeting criticized itself in this respect. I can assure you, however, that there is a report coming out of a National Academy of Sciences committee in which the apportionment of radioactive contamination in the human environment to various sources has been made. In defending our numbers here I will say that we are going to be several thousand times below hazardous levels, at the maximum levels, we consider. So I think there is time to make the revision that you suggest. I agree thoroughly it should be made.

Mr. RAMEY. Every time we look at a particular hazard we always find that it is taken as the sole hazard. We have gone through a whole series of hearings on these factors. The whole spectrum has to be sort of parceled out, as you say, somewhere.

Mr. CARRITT. That is right.

Representative HOLIFIELD. As this time I would like to ask your indulgence in recognizing Mr. Perry, administrative assistant to Senator Lyndon Johnson. I understand you would like to address the committee this morning, or file a statement.

Mr. PERRY. Senator Johnson had intended to be here to make a short statement but because of demand on the Senate floor at the moment he could not be and asked if I might be given a minute to read his statement for the record.

Representative HOLIFIELD. Yes.

Mr. PERRY. Thank you, Mr. Chairman.

STATEMENT OF HON. LYNDON JOHNSON, A U.S. SENATOR FROM THE STATE OF TEXAS, PRESENTED BY ARTHUR PERRY, ADMINISTRATIVE ASSISTANT TO SENATOR JOHNSON

Mr. PERRY. Thank you, sir.

The matter before us today is one which has caused great concern among the people who live along the gulf coast.

I hope that we can arrive at some resolution of the issues. I have not had the opportunity of studying Congressman Thompson's bill thoroughly, but I believe it affords an excellent point of departure for a thorough inquiry. The members of this committee have the experience and the skill and the staff to come to a prudent decision.

The people along the gulf coast have a heavy stake in this issue. Fishing and shrimping are important industries to the State of Texas. So, there is not only a natural concern for the preservation of human health, but added to it is concern over a basic factor in the Texas economy.

I have gone into this matter as thoroughly as I could with my limited resources. It appears that there are questions that have yet to be answered.

It is very important to my State and ultimately to the people of the country that we have clear and unequivocal answers, and I know that this committee will do everything that it can to get them.

Thank you.

Representative HOLIFIELD. Thank you, sir. You can assure the distinguished majority leader of the Senate from Texas that this committee will look into this matter very carefully.

Mr. PERRY. I certainly will. Thank you.

Representative HOLIFIELD. You may proceed, Doctor.

Mr. CARRITT. Thus, every 3.3 pounds of fish can contain up to $1.2\times10^{-2}\mu c$ of strontium 90 before it need be rejected from the human diet.

The biological processes which control the growth and development of fish in nature include processes that concentrate various elements within the organisms at levels greater than in the water. In the case of strontium 90, the concentration factor achieved by fish is unity; that is, the concentration within the fish is the same as in its environment. To be on the safe side here we use a concentration factor of 10 rather than 1, and can now compute the maximum concentration of strontium 90 that can be permitted in sea water.

Representative HOLIFIELD. This is not true of bottom-feeding shellfish?

Mr. CARRITT. Not of bottom-feeding shellfish, you are right. In the case of fish and strontium 90, the measured concentration factor is unity.

Using the maximum permissible concentration in fish as $1.2\times10^{-2}\mu c$ per 3.3 pounds or 1.5 kg. ($8\times10^{-3}\mu c/kg.$) and a concentration factor

between fish and water of 10, the maximum permissible concentration in sea water is $8\times10^{-4}\mu c$/liter or $8\times10^{-7}\mu c$/ml., which by coincidence is the same as the drinking water standard. We must now find a rate of release of activity to the sea that will prevent the concentration of strontium 90 in the water from exceeding $8\times10^{-7}\mu c$/ml. This will then represent the rate of disposal to the sea which separates safe from unsafe procedures.

It can be pointed out that the concentrations of radioactive substances we are concerned with here are many times below the concentrations that will damage marine organisms. Humans appear to be much more susceptible to radiation damage than marine organisms. Therefore, if we prevent the buildup to levels that will damage humans we will have automatically protected the marine organisms.

The problem of relating the quantity of radioactivity placed on the bottom and the rate with which it is deposited, to the concentration that will occur at various distances from the disposal site and at various times after disposal, is analogous to measuring the concentration of smoke at various distances downwind from a smokestack. The solution we have chosen to this problem is one that always provides an overestimate of the concentration. Thus, we have a built-in safety factor in all of our computations. The results of these estimates are best shown by figures which are in publication 655. An example which illustrates the diffusive mixing properties of the oceans is that at a distance of approximately five-eighths of a mile from the point of release of a contaminant the concentration will have been reduced by over a billionfold.

Application of dilution by diffusive mixing, noted above, to the practical problems of disposal neglects two features that will tend to prevent the contaminant from reaching the computed level. These are, (1) the containment afforded by the container during the time the steel canister is corroding and the concrete eroding away, and (2) the uptake of contaminant by the bottom sediments after being released to the water. The latter is a process that essentially amounts to additional containment. I would note here that containment, either in the disposal container or while absorbed on bottom sediments is time during which natural radioactive decay will reduce the amount af radioactivity and so reduce the concentration that will appear in the water. Adsorption on the bottom could be a possible source of hazard in an area supporting active shellfisheries. We have recommended that this possibility be checked prior to the start of disposal operations.

In our computation we have neglected containment and adsorption on the bottom and so have added an additional factor of safety in our results.

Thus, at any rate of disposal below the recommended maximum rate of 250 curies strontium 90 equivalent per year, or 100 curies in any one month, the concentration of contaminant at approximately five-eights of a mile from the disposal site will meet our specifications. Disposal sites that have been considered are either 10 x 10 miles or areas 2 miles in diameter.

Representative HOLIFIELD. It is interesting to note at that point the difference between the amount of curies you are permitting, 100 curies in any one month, to the amount that is being allowed in the Irish Sea.

According to your own report here the British are allowing 10,000 curies per month to be released from an open pipe 3 miles from the shore.

In the setting of your maximum rate here you have cut that down to 100 curies in any one month.

Mr. CARRITT. That is correct, sir.

Representative HOLIFIELD. And it is much farther out from the shore than is the case in the United Kingdom.

Mr. CARRITT. Yes, sir. We are considered very conservative in our estimates in Publication 655 by the British.

Representative HOLIFIELD. It is interesting to note that they raised the level recently from 1,000 curies per month to 10,000 because after they made a study of the fish life and the marine life and vegetable life, they found that the safety factor was such that they could lift it to 10,000 curies per month without danger.

Mr. CARRITT. That is right.

Representative HOLIFIELD. So it just shows, without comment upon which one is right, comparatively speaking, your study is much more conservative.

Mr. CARRITT. That is right.

Representative BATES. Mr. Chairman, on that point——

Representative HOLIFIELD. I was referring to the study and not the statement.

Representative BATES. In the summary of the AEC talking about that one site at Boston, they speak about 2,440 curies of byproduct and source material. Do you differentiate between curies of strontium 90 and byproduct?

Mr. CARRITT. Very definitely.

Representative BATES. I wanted to be certain about that.

Representative HOLIFIELD. Just as an aside, your strontium 90 would be deposited in the skeletal structure of a fish?

Mr. CARRITT. Yes, sir.

Representative HOLIFIELD. Therefore, it would probably constitute very little hazard to the person unless the person actually swallowed the bones.

Mr. CARRITT. We considered that, sir. Actually, in eating sardines and in eating salmon the bones are frequently eaten. Even though this is done we have put on an additional factor of 10 of safety over and above that in our consideration.

Representative HOLIFIELD. In the case of shellfish like shrimp, your danger would come from cesium 137 and iodine; would it not?

Mr. CARRITT. That is right.

Representative HOLIFIELD. Mostly from the cesium 137?

Mr. CARRITT. That is right.

There is one feature of the maximum permissible levels given in Handbook No. 52 and therefore, tacitly contained in our computed maximum levels in marine food products and in sea water—that is, that biological damage will occur after 30 years of continuous exposure to levels in excess of the maximum.

This, I think, is highly important. It is not just one fish or one crab or one shrimp that will kill you. Very likely it will do no harm at all. It is 30 years of exposure at levels above the recommended levels of Handbook No. 52.

Finally, I would like to emphasize the meaning of the list of suggested disposal areas given in publication 655. These are areas that we have recommended be examined in detail as possible disposal sites. They are not—and this I apparently cannot overemphasize—they are not areas that we recommend be immediately used as disposal areas.

Publication 655 clearly states that before disposal be started in any area a considerable amount of survey work be done to give much greater detail concerning the local conditions than the study group could obtain without much more work.

The survey of the areas in New England waters has already been started by the Coast and Geodetic Survey and will continue into the fall. Two areas, Nos. 2 and 2a, have been deleted from the list because the detailed look at the areas indicates that they are in an area that supports an active fishery.

I would note here that within the recommended rates of disposal, the problem of creating a hazard to fishermen's equipment by cluttering the bottom with disposal containers appears to be a greater hazard than that produced by the radioactivity.

In closing, let me say:

(1) Publication 655 does not recommend disposal at sea in preference to on land.

(2) It does set limits on disposal into near-shore water in event sea disposal be undertaken.

(3) The specific locations listed are not areas recommended as meeting all requirements of an area in which disposal can be safely done. It is recommended that these areas be examined in detail and on the basis of the information obtained the decision regarding the start of disposal operations be made.

Representative HOLIFIELD. Thank you very much, Doctor. I think that is a very considered and valuable statement. It strikes a note of conservatism and a note of caution on which I am sure should be carried to the people as some of the more scarey aspects of the story.

Mr. CARRITT. Thank you very much.

Representative HOLIFIELD. Are there any questions?

Representative BATES. I think probably a lot of this difficulty, Doctor, arose from the opening paragraph that you have in your recommendations which indicates that the panel is of the opinion that certain Atlantic and Gulf of Mexico coastal areas can be used as receiving waters for the controlled disposal of packaged low-level radioactive wastes. I read the whole report before and I knew you predicated it upon certain limitations which you set forth.

I think perhaps that one paragraph was taken out of context by a lot of people.

Mr. CARRITT. I wish I had realized that when we wrote it. I certainly would not have put it in there.

Mr. RAMEY. On page 12 of the report itself there is a reference that in considering your Handbook 52 value as your measure, no evaluation of possible genetic damage was attempted to be evaluated.

Will you look into that or is that a factor that should be taken into account? In other words, you are looking at somatic effects.

Mr. CARRITT. Yes, we are looking only at the pathological damage that could occur here.

I think it is not within the structure of the study group of which I was chairman, to do this. I think it is up to a group of genetic experts to do this and come up with samething similar to Handbook 52 on which we again can reevaluate, if necessary, the disposal into inshore waters. I am sure this is well outside of my field of competence.

Representative HOLIFIELD. I note that your criteria of computation is based upon the properties of radium.

Mr. CARRITT. That is Handbook 52, sir.

Representative HOLIFIELD. There is a notation in your report at some place by Dr. Revelle, who said that probably a new look should be taken at that.

Mr. CARRITT. I believe that is being done.

Representative HOLIFIELD. He expressed the thought that the original evaluation of the properties of radium might be higher than they actually are in the light of more recent scientific information.

Mr. CARRITT. That is right, sir.

Representative HOLIFIELD. So this adds another note of conservatism to your recommendations.

Mr. CARRITT. Yes, sir.

Representative HOLIFIELD. If this be true.

Mr. CARRITT. Yes, sir.

Mr. RAMEY. I have one question of AEC on this. What about the disposal of radioactive wastes that are not legally controlled by the Commission? What about radium used in hospitals, and isotopes that are developed as a result of cyclotron bombardments, and other things not subject to your jurisdiction? Are they subject to your jurisdiction?

Mr. PRICE. Radium that is used commercially is not subject to our jurisdiction. I do not know what the procedures are for disposing of the waste.

Mr. RAMEY. Would these commercial companies be the ones disposing of them? Would you run into this somewhere? Here you have a situation of disposal presumably going on somehow. Are they just going into ashcans like Mr. Durham said they have been going into all these years?

Mr. PRICE. I do not know what they do with radium. For all I know it is possible that some of these waste disposal people receive radium. To the best of my knowledge, I have not heard of any instances. I do recall some months ago there was a shipment to one of these west coast licensees of a bunch of radium waste but it was nothing that we had any control over.

Mr. RAMEY. Whether or not there is jurisdiction over this in AEC, it is still a hazard or factor that should be taken into account. Would it be possible for the Commission to give the committee a little report on these things that are not within their jurisdiction that are being disposed of?

Mr. PRICE. We will certainly do the best we can.

Let me say this: If a waste disposal licensee is disposing of radium along with other material, our regulations would require that the total package be packaged so that the shielding was sufficient to prevent exposure to people during shipment and handling.

In other words, he would have to make the whole package safe under our standards.

Representative HOLIFIELD. This would be more properly in the hands of either the Public Health Service or the State health departments.

Mr. PRICE. That is right.

Representative HOLIFIELD. At the present time?

Mr. PRICE. At the present time.

Representative HOLIFIELD. Thank you, Mr. Price.

The committee is adjourned. There will be no further hearings on this matter tomorrow in view of the fact that we have covered the list of witnesses, but the record will be held open the rest of the week for the filing of statements.

I have a statement from Hon. John E. Fogarty, a Representative from Rhode Island, and also one from the Washington Committee for a Sane Nuclear Policy.

(The statements referred to follow:)

STATEMENT OF HON. JOHN E. FOGARTY, U.S. REPRESENTATIVE OF THE SECOND CONGRESSIONAL DISTRICT OF RHODE ISLAND

Mr. Chairman and members of the committee, I appreciate your courtesy in permitting me to present my views on the proposal to dump radioactive waste in waters adjacent to the shores of my State of Rhode Island.

Following the report of the Committee on Oceanography of the National Academy of Sciences and its attendant publicity, a veritable barrage of opposed public opinion developed in my State. This despite the fact that the Academy stated as its opinion, and spelled out in some detail, that the material was low intensity waste and that no possible harm could come from such dumping. The nub of the matter is, however, that our people have been so subjected to conflicting statements, and at times actual misstatements on the problem of radioactive danger and atomic fallout over the past few years, that they have become conditioned to look with suspicion on any statement on the subject. And rightly so.

With regard to atomic fallout alone, the contrary claims, charges, and counter charges are frightening. Just last week the Public Health Service reported that its experts had found that the Animas River in Colorado and New Mexico, below a uranium refinery, contained samples as high as 160 percent above the maximum safe level for health. And this river is used as a source of supply for the homes of 30,000 people. The Public Health Service also found that vegetables grown by irrigation from this water contained not only radium but also surprising amounts of strontium 90 which could have only come from nuclear-test fallout. Samples of these vegetables contained readings of up to 12 times the maximum permissible level set by the Atomic Energy Commission. This is but one of many examples which the American people read about after previously being assured that no health problem exists.

It is incidents such as this, after previous assurances of safety and complete control, that cause our people to wonder as to just how much credence can be placed on the public pronouncements we receive with such regularity. It is interesting to note that there has been one element of consistency in testimony by scientific groups. Generally speaking, scientists working for or in connection withthe Atomic Energy Commission have tended to minimize fallout and radiation danger. On the other hand, civilian scientists and scientific groups not associated with the AEC have repeatedly sounded the alarm.

My own observation is that the Atomic Energy Commission has a regrettable record of equivocation in setting forth the health hazards of nuclear radiation. It has withheld information for months. We have reason to believe that some of the facts might never have been publicized had it had its own way. It is particularly disturbing to realize that vital information affecting the health of our own families may at this very moment be denied us. Much of the information we have been given is the result of the labors of your Joint Committee on Atomic Energy, Mr. Chairman, and not at the initiative of the Atomic Energy Commission itself.

It was because of these factors, so well typified by the present problem, that I introduced my bill, H.R. 7014, in this session of Congress. The bill provides for the vesting of primary responsibility for the protection of the public health and safety from radiation hazards in the U.S. Public Health Service. At the time of introduction I stated: "There has been entirely too much confusion and contradiction in the evidence that has been presented both to the Congress and to the American public with respect to the dangers inherent in the radiation hazard

problem. That problem, as I see it, is one of health. Logically, it should rest with that agency of Government charged with the fostering and the protection of the Nation's health—the Public Health Service."

Since that time my conviction has been strengthened. I know that the people of Rhode Island would rest much easier if they knew that the U.S. Public Health Service was controlling the present proposal for the dumping of radioactive waste off our shores.

Certain things we know. The growing application of atomic energy has resulted in the production of radioactive waste materials which must be safely and practically disposed of by storage, discharge to liquid waste handling systems, incinerations, burial on land or by dumping in the sea. Recommendations have been suggested that disposal of such material to the oceans be predicated upon separation of the waste from the ocean environment by a container of suitable integrity. However, present knowledge of the behavior of these containers does not provide sufficient assurance of their integrity. This raises the question of the extent of contamination released to the marine environment in the disposal area and the path of the released radioactivity through the marine food chain to man.

Valid answers to these questions require field measurements of released radioactivity in the disposal sites, determination at points of human exposure of the extent of the concentration of radioisotopes through the marine cycle, local ocean usage (food, recreation, etc.) and integration of the experimental results to yield meaningful "permissible" concentrations of significant radioisotopes in ocean waters and waste disposal rates in the particular areas. To date available information has limited applicability to the above factors. Few if any field measurements have been made in the ocean disposal areas currently in use. Studies of marine life and their radioisotope concentration capabilities are incomplete. The required compilation and analysis of experimental information by competent health authorities has not been done due to lack of data.

Within this general evaluation, it is important that health agencies maintain surveillance of the waste disposal practices within their jurisdiction and that State and Federal agencies conduct appropriate studies of the environment at the ocean disposal sites. Concurrently health agencies should maintain surveillance and control of radioactivity resulting from ocean disposal practice affecting human exposure directly or indirectly. And over all should be the operation of the U.S. public health agency charged with the responsibility of protecting the health of the Nation from all radiation hazards.

Seacoast States in particular have a real interest in knowing that the radioactive materials from time of use to ocean disposal are handled in such manner that return via the mairne food chain or directly to the environment of man in his recreational waters is not significant from the standpoint of public health. I submit that the best method to assure this would be to vest protective responsibility in our Public Health Service. This committee could aid in gaining that objective immeasurably by adding its strong recommendation for the immediate passage of the type of legislation which I have described.

Mr. Chairman, I would like to include in my testimony two editorials from the Providence Sunday Journal of July 19, 1959, and the Providence Journal of July 24, 1959. I think that they give an excellent background on the impact of the problem on the people of my State. I would also like to include telegrams which I have received from William P. Lewis, Rhode Island State senator from Block Island, R.I., and from Harvey S. Reynolds, Rhode Island senator from Little Compton, R.I. In addition, I submit a letter received from Howard L. Bell, of 244 Pleasant Street, Rumford, R.I.

(The material referred to follows:)

[From the Providence Sunday Journal, Providence, R.I., July 19, 1959]

WHY DUMP NUCLEAR WASTE OFF OUR SHORES?

The selection of three sites off the Rhode Island shore as possible dumping places for radioactive wastes isn't the sort of news that will be greeted hereabouts with rejoicing, or even with equanimity. After all, "radioactivity" is a frightening word. Every schoolboy knows by now that radioactivity is the fearsome emanation that makes nuclear reactors dangerous, provides the element of terror in nuclear fallout, and may make our contemplated future travels into outerspace difficult or impossible. The prospect that quantities of radio-

active waste may be dumped into the sea a few scant miles from Block Island and Sakonnet naturally evokes some concern.

Rhode Island offshore waters aren't the only ones selected as possible dumping sites. An eight-man panel of experts, headed by Dr. Dayton E. Carritt, associate professor of oceanography at Johns Hopkins, has picked 28 possible offshore sites between Massachusetts and Texas which it thinks could serve the purpose. (Congressmen have filed a vigorous protest.)

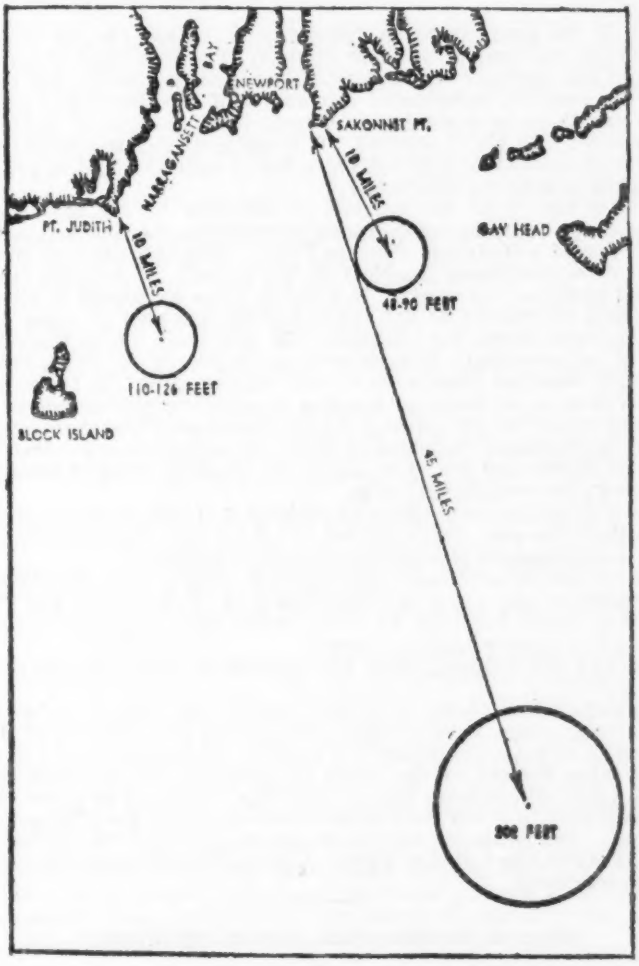

Chart shows proposed dumping sites.

Three elements in this panel recommendation should allay our worst fears, even if they don't offer much comfort.

First, the experts have studied the situation for a year and a half and are convinced that no harm will result from the dumping in relatively shallow waters offshore.

Second, they specifically recommend that further studies of marine life, current flows, and structure of the bottom be made at each site before any dumping begins.

Third, the radioactive wastes to be dumped in these areas so close to shore must be low-intensity wastes. By that, they mean products from the reactors or the laboratories which are only slightly radioactive, or which can be expected to decay and become harmless in a relatively few years.

The much more violently radioactive "ashes" withdrawn from the nuclear reactors at Hanford, at Oak Ridge, or from our nuclear submarines could never be disposed of safely in the ocean so close to shore. This material remains lethal for centuries. Most of it now is being dumped into lead-lined concrete vats deep in the ground near Hanford, Wash. It must remain there, out of contact with every living thing, for at least 600 years, the National Academy of Sciences says. By that time, it is estimated, the most dangerous constituents, strontium 90 and cesium 137, will have decayed sufficiently to become relatively harmless.

But even if the products to be dumped into the sea are the low-intensity wastes, there is still ample room for disquiet. Precious little is known about the effects of radioactivity on mankind. Even less is known about its possible effects on the complex, interrelated community of life that exists beneath the sea. It is one thing to study in the laboratory the effects of radiation on a crab, a mackerel, or a bit of seaweed. It is quite another to expose the myriad forms of life at sea to a steady concentration of radiation and to project what the results may be some decades hence.

A few years ago, when the problem of disposing of our mounting pile of radioactive waste began to reach sizable proportions, the National Academy of Sciences conducted a study and concluded that: "The only place on earth where dispersal can be considered practical is the ocean." It rejected the idea of underground tanks as too costly. It brushed aside as wholly impractical the suggestion that the wastes be put inside rockets and shot to outer space.

But in the ocean deeps, the scientists said, are areas where there is no life and virtually no movement. The water at the depths of the Black Sea, it cited as an example, requires 2,500 years to rise, ever so slowly, to the surface. So why not use these ocean deeps as dumping grounds for radioactive wastes?

The answer is that we are learning a great deal more about these ocean deeps. During the International Geophysical Year, the scientists discovered that the deeps are not lifeless and are by no means the stagnant pools of almost motionless water they once were thought to be.

This new information contradicts everything that had been accepted earlier. It suggests that the ocean deeps are not at all the safe hideaways which mankind might use as dumping grounds for radioactive products.

The point is that we must move with greatest caution when we know so little about radioactivity and about the characteristics of the ocean and the life it contains. Who knows but what we accept today as fact may be repudiated by the new facts that come to light tomorrow?

And why was this proposal made for radioactive dumping sites only a few miles offshore?

The only explanation seems to be that lugging the wastes farther to sea is proving too costly. The Atomic Energy Commission now disposes of its wastes 100 to 200 miles at sea. The material is encased in concrete, sealed in 55-gallon drums, and taken far out off the coasts of Massachusetts and New Jersey for dumping in water that is more than a mile deep. It would be much easier and much less expensive to dump these drums closer to shore, the AEC points out.

So it would. But ordinary wisdom should suggest that the economic factor should not be overriding and that a great deal more study should be made before this proposal is adopted.

[From the Providence (R.I.) Journal, July 24, 1959]

AFTERTHOUGHTS ON NUCLEAR DUMPING

The latest development in the proposal to establish dumping places for nuclear wastes offshore is hardly calculated to inspire confidence.

Two of the three tentative sites off the Rhode Island shore have been scratched from the list, Dr. Dayton E. Carritt reports. And why were they eliminated? Because, Dr. Carritt explains, the U.S. Fish and Wildlife Service has pointed out that these particular sites are in waters that support commercial fishing.

Now a layman can't be expected to be expertly informed on the degrees of hazard in radioactive waste. But even the least informed laymen can catch the disquieting implication in this development. The implication is that the nuclear wastes are too dangerous to be placed in waters where fishing is being carried

on. And if the nuclear wastes are that dangerous, the layman is entitled to ask if the ocean currents and the schools of moving fish couldn't spread the danger from any dumping site offshore, however far removed from the active fishing grounds.

Even more disquieting is the on-again off-again performance of the eight-man panel of experts headed by Dr. Carritt, an associate professor of oceanography at Johns Hopkins University. These experts reportedly studied the problem for a year and a half, selected their 28 proposed dumping sites from Massachusetts to Texas, and submitted their recommendations to the Atomic Energy Commission. Yet in a year and a half of study, none of the eight experts seems to have learned that two of the selected sites off Rhode Island were in waters that support commercial fishing. This information turned up only as an afterthought. When it did turn up, the experts hastily revised their list and eliminated those Rhode Island sites.

There's nothing secret about commercial fishing. Areas where this enterprise is carried on can be identified readily. Surely a panel of experts concerned with the matter, and with a year and a half in which to collect the information, should have no difficulty obtaining the data. But this panel seems to have slipped up somewhere.

Still another point of confusion concerns the nature of these particular nuclear wastes that are to be dumped offshore. They are called low-intensity wastes or low-level wastes. But no one in authority has yet explained how low is low. If the level of radioactivity is sufficient to cause mutations in the organisms of the sea, it could be a serious cause for worry. On the other hand, if the radioactivity is as low as it is, say, on the face of a radium-dialed wristwatch, the drums of waste might be stored next to a playground or a bathing beach with no harmful effects.

Comdr. George F. Bond, Chief of the Navy's Medical Research Laboratory at Groton, thinks the hazard may be rather low. He even suggests that it might be safer to dump the wastes in shallow water rather than in deeper water farther from shore. "Frankly," he says, "I can't see any hazard to putting wastes in shallow waters where it can be monitored and recovered if necessary."

There is something to be said for this arrangement. But a weekly or monthly check on the degree of radioactivity, while it would yield a figure on the Geiger counter, wouldn't tell a thing about the effects that radioactivity might impart to future generations of plankton and fish life.

Dr. Carritt was surprised when he was told of the widespread concern his panel's report had touched off.

"All of this indicates," he said, "that the Atomic Energy Commission will have to start educating the people from the top politicians on down."

Perhaps a good place to start that process of education is the congressional hearing scheduled to start next week. Responding to the urgings of Senator John O. Pastore and others, Representative Chet Holifield, Democrat, of California, has summoned his radiation subcommittee to meet next week. He will call up members of the AEC and of the National Academy of Sciences in an effort to clear up some of the unanswered questions surrounding this nuclear disposal problem.

We suggest that this educational process should be designed to work two ways. The public needs to know more about the project. The officials need to know, much better than they now seem to know, that the public is deeply concerned about radioactivity and deeply disturbed by the casual way in which some of the officials are treating the subject.

PROVIDENCE, R.I., *July 20, 1959.*

Congressman JOHN E. FOGARTY,
House Office Building, Washington, D.C.:

People of Little Compton and all southern Rhode Island greatly disturbed by proposed dumping of radioactive waste close to our shores. Trust you will use your influence to halt this ill-advised proposal which would be most damaging to Rhode Island, either from actual contamination or from fear of same.

HARVEY S. REYNOLDS,
Senator, Little Compton.

BLOCK ISLAND, R.I., *July 19, 1959.*

Hon. JOHN E. FOGARTY,
U.S. House of Representatives, Washington, D.C.:

Excellent editorial in Providence Sunday Journal, "Dumping Nuclear Waste on Rhode Island Shores." People along our shores very much opposed to dumping radioactive waste in locations suggested. Hope you will do everything in your power to prevent same.

WILLIAM P. LEWIS,
State Senator from Block Island.

RUMFORD, R.I., *July 20, 1959.*

Representatives JOHN E. FOGARTY,
House of Representatives, Washington, D.C.

DEAR REPRESENTATIVE FOGARTY: The writer has already written to Senator Green and the President voicing his feelings on the matter of the recent plan to dump waste atomic materials in Atlantic Ocean area quite adjacent to our Rhode Island coastline.

I am unalterably opposed to this plan, at least in its present form. We do not want such materials dumped within a close proximity to our coastline. The reason for this conclusion is obvious. It presents possible contamination of ocean waters and the deteriorating effect on marine life.

We will tolerate nothing which is going to have any possible effect such as outlined with respect to our salt water areas.

The writer has posed the question as to how this particular area was chosen. Why wasn't some other location selected? Why not off the coast of California or Oregon? We do not want the dumping in our area but, interestingly, we'd like to know how the Commission arrived at the conclusion of their selection.

Rhode Island is precious to her people, as we feel that you must know as well, being a son of Rhode Island. Therefore, you can certainly realize that anything which hurts our State is going to be rejected.

Your efforts in fighting this measure are solicited and trust that nothing is done on this matter which would hurt our State of Rhode Island.

Thank you for your kind attention and cooperation on the subject.

Respectfully yours,

HOWARD L. BELL.

STATEMENT REGARDING HEARINGS BEFORE THE JOINT COMMITTEE ON ATOMIC ENERGY, SUBCOMMITTEE ON RADIATION, DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE INTO THE OCEAN

INTRODUCTION

The Washington Committee for a Sane Nuclear Policy is the local branch of the National Committee for a Sane Nuclear Policy, a citizens' organization with a fast-growing nationwide membership. The Washington committee has over 400 members who are deeply concerned over the possible consequences of a nuclear policy determined by considerations of expedience and economy rather than by careful research, planning, and due regard for the public health.

STATEMENT ON RADIOACTIVE WASTE DISPOSAL

Time and time again, there have been hearings held which were of vital importance in the general field of radiation safety, but which were limited in testimony largely to AEC officials who were understandably not eager to reveal the shortcomings of present radioactive waste disposal methods, regulations, and enforcement of regulations. Repeatedly, the AEC has been found to be in error regarding the safety of certain practices, for example, the rate at which fallout descends to the earth, and these errors almost always appear to be released to the public only long after they are discovered.

The Joint Committee on Atomic Energy is now holding hearings on the disposal of radioactive waste materials in the ocean. To be effective and impartial, these hearings should include testimony from nongovernmental scientists who are active in the fields of public health, radiation biology, physics, chemistry, agronomy, marine biology, and engineering. Scientists in State government agencies who have an official interest in such public health problems should be invited to testify.

The issues involved are important in a long-range sense as well as in terms of immediate perils because of the admittedly dangerous genetic effects which will result from a prolonged increase in radiation exposure to the general population and to aquatic life. It should not be necessary to wait for genetic defects to become widespread and beyond control before deciding what to do about the situation. It will then be too late.

The National Advisory Committee on Radiation prepared a report to the Surgeon General dated March 1959, in which it is pointed out that radiation exposure is rapidly increasing from all manmade sources such as X-rays, power reactors, nuclear-powered vessels, fallout, medical radioisotopes, and nuclear materials. Exposure in other countries is also accelerating. In at least one case, Great Britain, power reactor wastes are being pumped directly into the sea in disregard of safety practices recommended by our National Committee on Radiation Protection. That committee states in its report, "Radioactive Waste Disposal in the Ocean," that "In a field as new as this, it is impossible to foresee what quantities of activity discharged into the oceans will produce undesirable consequences." If this is the sad state of our knowledge at the present time, we should not take irrevocable action which may later serve as a precedent for unsafe disposal methods and which may do great harm.

The International Atomic Energy Agency estimates that 36 power reactors will be in operation by 1962. This is probably a gross underestimate since only nine nations were listed, and so little is known of what is being done in Communist countries. These reactors will yield millions, even billions of gallons of new waste products, the safe disposal of which will tax our facilities and ingenuity to the utmost extent. Dr. Joseph A. Lieberman of the AEC has said that high-level waste storage facilities may have to be maintained for many hundreds of years. We already have an "atomic cesspool" of 60 million gallons achieved at a cost of about $2 per gallon. Long before this activity is gone, production of wastes may amount to billions of gallons each year. How can such amounts be disposed of safely? There is as yet no practical known method, according to scientists working on the problem.

Both disposal at sea and burial in restricted land areas present great potential hazards, especially in view of the long half-lives of the materials involved. Containers presently used for sea burial may last less than 10 years. In fact, some scientists believe that a much shorter period would be closer to the truth because of porosity of the cement liners, corrosion accelerated by sea water, and the high pressures exerted on drums on the ocean floor. Measurement of radiation in the water where materials have been dumped may have no significant bearing on the problem since diffusion, ocean currents, density differences, retention of radioactive substances by fish, and migration of fish all contribute to rendering the measurements inconclusive.

Land storage presents formidable problems related to possible accidents, fires, earthquakes, lightning, or even sabotage. The radioactive materials being stored represent a possible danger to human beings both as individuals and genetically, yet evidence already exists showing negligent pollution of the air, streams, croplands, and our water and food supplies through improper disposal methods. Land disposal in proper containers has the advantage that waste materials can be recovered or better shielded in the future if this is deemed necessary and if really adequate methods are found. Such containers can also be readily inspected to make sure that leakage has not occurred. Ocean disposal lacks these advantages and, furthermore, has inherent risks which are largely unknown.

In view of these considerations, the following recommendations are presented for the protection of the present population as well as future generations:

1. Disposal of radioactive materials at sea, in lakes, or in rivers should be prohibited at once, whether in containers or not, pending further scientific study. Disposal now and study later is an inexcusably reckless attitude.

2. Private corporations should not be allowed to begin operations involving radioactive waste disposal until adequate safety measures are taken and facilities are available for safe storage of wastes. Until now, the reverse has often been true, and company expense has been used to justify violations of established radiation standards. Such cases should be acted upon immediately as is finally being done by the Public Health Service in the case of the Vanadium Corp. of America.

3. The Public Health Service should be given immediate and extensive authority to deal with all aspects of radiation safety, including all methods of radioactive waste disposal, and even the big offender, medical X-rays.

4. The United States should, either on its own or through the United Nations, encourage all countries to adopt strict regulations on radiation safety matters. International agreements should be executed to prevent contamination of the oceans, rivers, and the air.

If action is not taken soon in this field, the rapid growth of radiation-producing facilities will make the problem almost impossible of solution. Once large investments are made by private enterprises in plants and equipment, it will be exceedingly difficult to correct unsafe practices which result from design factors and which are perpetuated by cost considerations. And it will be too late to do anything about the radiation which already will have been released. The time for stricter regulations, for more rigid enforcement, and for accelerated radiation safety research is now.

(Whereupon, at 5:10 p.m., the hearing was adjourned.)

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